RATIONALE FOR
THE DEVELOPMENT AND APPLICATION OF GENERIC SOIL, GROUNDWATER AND SEDIMENT CRITERIA
FOR USE AT CONTAMINATED SITES IN ONTARIO

REVISED DECEMBER 1996

Ontario

Ministry of
Environment
and Energy

ISBN 0-7778-5906-8

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PIBS 3250E01

Version 1.1

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Report prepared by:

Standards Development Branch
Ontario Ministry of Environment and Energy

Report prepared for:

Ontario Ministry of Environment and Energy

Version 1.1

Acknowledgements

This document was prepared by the Criteria Development Subgroup (A. L. Kuja, Chair) under the direction of the Criteria Development, Site Assessment and Site Specific Risk Assessment Work Group (R.G. Pearson, Chair). Following consultation, all modifications were made by the document editors: A. L. Kuja and R. G. Pearson, Phytotoxicology Section, Standards Development Branch.

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The Criteria Development Subgroup would also like to recognize and thank the Massachusetts Department of Environmental Protection, Bureau of Waste Site Clean-up and the Office of Research and Standards for their co-operation in providing the committee with the MCP Standards Approach background document and databases.

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1 INTRODUCTION

This document describes the rationale behind the development of effects-based generic soil, groundwater and sediment quality criteria, to be used in place of the 1989 soil clean-up levels in the remediation of contaminated sites in Ontario. This rationale document replaces the document entitled "Soil Clean-up Guidelines for Decommissioning of Industrial Lands: Background and Rationale for Development". The use and application of these criteria are described in the "Guideline for Use at Contaminated Sites in Ontario" (1996) which replaces the MOE 1989 "Guideline for the Decommissioning and Clean-up of Sites in Ontario" and the 1993 "Interim Guidelines for the Assessment and Management of Petroleum Contaminated Sites in Ontario".

This introduction is the first of four sections comprising the rationale document. Section 2 provides an overview of the environmental approach, guiding principles, and remediation options and their linkage with the criteria development process. Section 3 describes in detail, the process and assumptions used in the development of the soil and groundwater criteria. This includes a full description of the Massachusetts methodology that was adopted for use in Ontario, as well as the modifications and additional components that were utilized. All references utilized in this document are listed in Section 4. The criteria tables, on which decisions relating to site remediation will be based, are found in Appendix A. Also provided in Appendix A are summary tables of all criteria components. Additional scientific documents and supporting information for the development of the criteria are found in Appendix B.

2 OVERVIEW OF THE APPROACH, GUIDING PRINCIPLES AND MAJOR ASPECTS OF THE CRITERIA DEVELOPMENT PROCESS.

2.1 General Approach

The revision of the Ministry's 1989 guideline for the decommissioning and clean-up of contaminated sites is predicated on providing a more flexible, environmentally protective approach which will be applicable to a greater number of environmental contaminants and provide an increased level of guidance and remediation options to proponents. From an environmental aspect, this flexibility was achieved by more closely matching receptors and exposure pathways to land and groundwater use categories, and to the extent possible, to site conditions which affect contaminant transport and exposure.

The MOEE has participated in the development of a protocol for setting effects-based soil quality criteria under the National Contaminated Sites Remediation Program of the Canadian Council of Ministers of Environment (CCME). These protocols are summarized in the CCME document entitled "A Protocol for the Derivation of Ecological Effects Based and Human Health Based Soil Quality Criteria for Contaminated Sites." (1994). However, as the development of soil clean-up criteria based on CCME criteria documents will take several years, the MOEE explored other options to provide effects-based criteria.

The Department of Environmental Protection, Bureau of Waste Site Cleanup and the Office of Research and Standards for the Commonwealth of Massachusetts, have jointly produced chemical-specific standards for use under their revised Massachusetts Contingency Plan (MCP) which was promulgated in October 1993. Generic criteria for 106 inorganic/organic contaminants were developed using a risk characterization approach to provide protection to human and environmental health.

After a review of the general assumptions and multi-media components of the MCP approach, a decision was made to adopt and modify this approach for generic soil and groundwater "risk-based" site remediation criteria in Ontario. The MCP approach was selected as it appeared to best meet Ontario's needs for a large number of effects-based soil and groundwater criteria which address most potential human health and aquatic exposure pathways. It was also chosen because both the toxicological assessments and exposure scenarios carried out by the Massachusetts Department of Environmental Protection (DEP) had been subjected to extensive public consultation and had been promulgated as standards.

All assumptions for risk characterization, dose-response and toxicity information, methods, calculations and data inputs to the MCP standards development process are detailed in the Massachusetts document entitled "Background Documentation for the Development of the MCP Numerical Standards" (1994). The relevant portions of this document have been included in Appendix B.5. Modifications were made to various inputs into the MCP spreadsheets so that the criteria for the 106 chemicals would better represent the Ontario situation.

2.2 Remediation Options Provided by this Approach

2.2.1 Land Use Categories

Three land use categories, which provide greater flexibility in the development and application of criteria based on more relevant assumptions regarding sensitive receptors and exposure scenarios, are proposed. The land use categories include: 1) Agricultural, 2) Residential/Parkland, and 3) Industrial/Commercial.

In separating the agricultural category from the residential/parkland category, ecologically based soil criteria designed to protect grazing animals and bio-accumulating plant species will no longer be applied to residential and parkland sites. As in the past, the commercial category has been grouped with the industrial category.

2.2.2 Soil Texture

The mobility and plant availability of inorganic and organic compounds in soil is dependent on soil texture. For this reason, soil and groundwater criteria are proposed for both coarse textured and medium/fine textured soils. Coarse textured soil is defined as material having greater than 70% (by dry weight) of soil particles equal to or greater than 50 um diameter (sand). Material with less than 70% (by dry weight) sand sized particles is defined as medium/fine textured.

2.2.3 Remediation Depth

Two major depth options are provided for the remediation of contaminated sites. In the first case, proponents may choose a **Full Depth Remediation** utilizing generic criteria that result in the remediation of all soils/sediments/groundwater on site to effects-based levels protective of the most sensitive receptors characteristic of the particular land use.

The second option is a **Stratified Depth Remediation**, in which additional choices are provided by the separate development and application of criteria protective of receptors exposed to surface soil ($\leq$ 1.5 m depth) and sub-surface soil (>1.5 m depth). The 1.5 m cut-off depth was chosen because it lies below the rooting and main feeding zone of most plants, as well as being below the depth of typical residential excavations (e.g. installation of fence posts).

In the case of surface soils, these depths are considered minimum requirements that should exist following all remediation activity (i.e. normal settling of imported or remediated soils should be accounted for to ensure that the final surface layer depth meets these minimum requirements). Under this option, protection of terrestrial organisms is appropriately limited to the surface depth. In the case of direct and indirect human contact, exposure scenarios for surface and sub-surface depths will more realistically reflect the frequency and intensity of exposure.

2.2.4 Groundwater Use and Protection

Under both the Full Depth and Stratified Depth Remediation options, additional choices are provided on the basis of the status/use of the groundwater. If groundwater on and/or in the area of the contaminated site is being used or is likely to be used in the future as a potable water supply, then both groundwater and soil criteria must be protective of potable water quality. If the groundwater is not being used or is not likely to be used in the future as a potable water supply, then groundwater and soil remediation will not be required to be protective of potable water quality. In addition, for both the potable and non-potable situation, the requirement for a groundwater-based remediation is predicated on an assessment and comparison of on-site groundwater quality with corresponding up-gradient water quality (refer to Section 8 of the main guideline document). Groundwater use (potable vs. non-potable) selection criteria are also described in Section 6.3 of the main guideline document.

Irrespective of a groundwater supply being potable or non-potable, soil and groundwater quality protection will be provided for vapour migration from groundwater through the soil to indoor air and for groundwater discharge to surface water bodies. Protection for irrigation supplies, industrial/commercial use and other sensitive uses should be identified on a case-by-case basis and may require remediation to levels that are numerically lower than the respective potable and non-potable criteria values.

2.3 Guiding Principles and Major Assumptions

The development of effects-based criteria for the guideline was based on the following major guiding principles:

1. Remediation of contaminated sites will take place to levels which will protect against potential adverse effects or the likelihood of adverse effects to human health, ecosystem health and the natural environment and which will result in the removal of free product and waste materials.

2. The protection of human/ecological health and the natural environment will be predicated on effects-based criteria for soil, water and sediment quality. Development of the criteria will be based on:

    a) protection of relevant receptors in three land and two groundwater use classes, for both coarse textured and medium/fine textured soil situations,

    b) consideration of exposure frequency and intensity via relevant pathways,

    c) the physical and chemical characteristics that affect contaminant transport and fate in the environment.

3. The generic criteria will represent levels of contaminants at which no further remedial response actions would be required based upon the risk of harm posed by these materials.

4. The generic criteria represent one risk characterization option in the guideline; the flexibility exists to use a more site specific risk characterization approach.

A number of major underlying principles and assumptions have also been made:

i) Soil is a non-renewable natural resource that is essential for the current and future health and well being of the residents of Ontario; once contaminated, it is very difficult and expensive to restore.

ii) Soil criteria will be based on the most sensitive of four main components:

  a) human health - direct contact, ingestion and odour,

  b) leaching from soil to groundwater,

  c) vapour migration from soil to indoor air,

  d) terrestrial ecological protection.

iii) Groundwater is a shared, natural resource that is essential for the current and future health and well being of the residents of Ontario; once contaminated it is very difficult and expensive to restore.

iv) The protection of groundwater will take into consideration possible future uses of that resource and can not be based solely on the current presence or absence of a drinking water well.

v) In order to ensure the future quality of the groundwater in Ontario, the remediation of contaminated soil will take into consideration the leaching of those materials to the underlying groundwater aquifer.

vi) Groundwater quality will be based not only on its suitability for use as a source of drinking water, but also on its potential to transport and discharge contaminants to:

  a) surface water bodies, where contaminants could affect aquatic life,

  b) the vicinity of basement structures where volatile contaminants could migrate into indoor air and affect human health.

vii) Rather than trying to protect the most sensitive of all possible receptors in the generic criteria approach, the generic levels will be set to provide protection to most typical receptors; a set of site conditions at which the assumptions used in the generic criteria process may not provide protection - referred to as 'Potentially Sensitive Sites - will be described, such that if a site falls into this category, the proponent would have to undertake additional work to ensure that the generic criteria are protective.

2.4 Overview of the Generic Criteria Development Process

Generic clean-up criteria for soils and groundwater have been developed via an effects-based, component type approach designed to provide protection to human health, ecosystem health and the natural environment under exposure scenarios related to three common land-uses and two groundwater use groupings. The development of the numerical criteria was predicated on both direct and indirect exposures involving human and ecological receptors (terrestrial and aquatic) and through consideration of contaminant fate and movement and likely exposure pathways to sensitive receptors.

More specifically, the soil criteria have been set at a level below which adverse effects would be expected to occur or at which risk of adverse effects is considered negligible. The development of the soil criteria was also undertaken to ensure that any residual soil contamination would not result in effects on ambient air, indoor air or groundwater as a result of off-gassing, vapour migration or leaching, respectively. This was accomplished via the use of soil-air and soil-groundwater transport models.

In the case of groundwater, criteria were developed to provide protection for both potable and non-potable water supplies. The potable criteria incorporate protection of the groundwater for drinking water quality, potential migration of gases from the groundwater to indoor air and protection of aquatic species from groundwater discharge to surface water bodies. The non-potable criteria include protection against vapour migration to indoor air and groundwater water discharge to surface water (aquatic species).

In all cases, the effects-based concentrations were compared with analytical detection capabilities and existing background soil and indoor air quality to ensure that the criteria would not be set at a value below these levels. In the case of groundwater, the background water quality is addressed in a site specific manner through the site assessment process.

The effects-based concentrations were also compared with ceiling concentrations established to minimize odour problems and the general deterioration of soil and groundwater quality, recognizing that once contaminated, it may not be possible or feasible to completely return these media to normal levels. The ceiling concentrations also make some allowance for possible new research which, in some cases, may result in the need to reduce the effects-based concentrations. As a result of these built-in risk management type alterations, the final (most sensitive) numerical value for the human health or ecological component for any given parameter was adjusted up or down, resulting in a departure from the original human health risk level or in the percentage of the total tolerable intake allocated to that receptor's exposure pathway.

In the case of extremely sensitive sites, where the generally conservative, generic assumptions may not provide an equivalent level of human health or ecological protection, the risk to receptors at the site must be assessed on a case by case basis and if necessary, the generic criteria further reduced in value.

Provincial sediment quality guidelines (PSQGs) have been adopted from the 1993 MOEE document entitled "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario." These guidelines (lowest effects levels) were developed for use in evaluating sediments throughout Ontario, and replace the Open Water Disposal Guidelines (published by the Ministry in 1976). The use of the PSQG sediment criteria in a site remediation is described in Section 8 of the main guideline document.

3 PROCESS USED TO DEVELOP THE GENERIC SOIL AND GROUNDWATER REMEDIATION CRITERIA

3.1 The Massachusetts Contingency Plan (MCP)

The MCP approach is based upon assumed human exposure scenarios for both current and future uses of a site and its surrounding environment. Risk characterizations are derived for several soil and groundwater categories for which appropriate risk-based criteria are then developed. In addition, the MCP approach considers the potential for organic chemicals to leach from soil to groundwater. The following sections outline the main aspects of the Massachusetts risk characterization categories and criteria development process.

3.1.1 MCP Toxicological Assessments

In the MCP Approach, dose-response information for developing risk-based criteria is grouped as follows:

- Toxicity information associated with threshold (non-carcinogenic) health effects.
- Toxicity information concerning carcinogenicity, either from human epidemiological studies or from laboratory animal studies.
- The Relative Absorption Factors used to relate toxicity values from the literature to the exposure pathways of concern.

Oral Reference Dose (RfD) and Inhalation Reference Concentrations (RfC) information, obtained from the 1995 USEPA Integrated Risk Information System (IRIS) database are utilized. Subchronic RfDs from the USEPA Health Effects Assessment Summary Tables (HEAST) were used in the development of one soil category. Human health toxicity data derived by MOEE Standards Development staff were used for inorganics not addressed by Massachusetts.

For a limited number of chemicals, for which subchronic and chronic RfDs and RfCs were not available from the EPA databases, an analogous toxicity value was developed by the

Massachusetts DEP Office of Research and Standards staff. The USEPA derived oral Carcinogen Potency Values (CPV) from IRIS and HEAST were used to evaluate both oral and dermal exposure to carcinogens.

3.1.2 MCP Soil Categories

In the MCP approach, the applicability of criteria for a particular soil category is dependent upon both accessibility of the soil (measured primarily by depth) and the frequency of human activities which may take place at the surface of a site, currently, or in the foreseeable future. Standards for each soil category are primarily based upon human health risk assessment for both children and adults, associated with direct exposure resulting from dermal contact and ingestion of soil and dust. A selection matrix to determine the appropriate soil categories based on soil accessibility, receptor characteristics, and the frequency and intensity of exposure is shown in Figure 1 (same as Figure 1.1 in the MCP background document for the development of numerical standards). Massachusetts has developed three general soil categories (S-1, S-2, and S-3) to represent the various combinations of receptors and exposures.

3.1.2.1 S-1 Soil Category

This category addresses sites associated with high exposure, i.e. a residential exposure scenario where a potential child receptor may have direct contact with contaminated soil while playing in the yard. For non-cancer health effects, the receptor of concern is the young child (aged 1 to 6 years) who comes into contact with contaminated soil and household dust of soil origin. For carcinogenic effects, the receptor of concern is the resident (aged 0-30 years) who comes into contact with soil as in the case of a young child, and as an adult, while working or gardening in his or her yard. Typical (median) age-specific body weights were employed in assessing exposures (see 3.1.2.3).

3.1.2.2 S-2 Soil Category

This category is based upon property uses associated with moderate exposure and accessible soils. Standards are based on an exposure scenario where a potential adult receptor may come in contact with contaminated soil in a work environment, or passive recreational setting (both children and adults in the latter case). For both cancer and non-cancer health effects, the receptor of concern is a worker (age 18-45 years) who comes into contact with soil as part of their employment. As in the previous soil category, typical (median) age-specific body weights were employed for deriving risk-based criteria in this category.

Figure 1: MASSACHUSETTS SOIL CATEGORY SELECTION MATRIX - HUMAN EXPOSURE POTENTIAL

	RECEPTOR CHARACTERISTICS							
	CHILDREN PRESENT				ADULTS PRESENT			
	HIGH FREQUENCY		LOW FREQUENCY		HIGH FREQUENCY		LOW FREQUENCY	
	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity
ACCESSIBLE SOIL (0 - 0.9m)	S-1	S-1	S-1	S-2	S-1	S-2	S-2	S-3
POTENTIALLY ACCESSIBLE SOIL (0.9 - 4.6m)	S-1	S-2	S-2	S-3	S-2	S-3	S-3	S-3
ISOLATED SUB-SURFACE SOIL (> 4.6m)	S-3				S-3			

S-1, S-2 and S-3 represent Massachusetts general soil categories

3.1.2.3 S-3 Soil Category

This soil category applies to restricted access to property and soil with limited potential for exposure, either currently or in the foreseeable future. S-3 criteria are based upon an exposure scenario where the potential receptor may come into contact with contaminated soil during a short but intense exposure, such as excavation work. For non-cancer effects, it is assumed that the exposure occurs over a period of three months, but for carcinogenic effects it was felt that such a short exposure duration was beyond the limits of the cancer risk model to estimate risk. As a result, a seven year exposure was used to evaluate potential cancer risk to the excavation/construction worker. Typical (median) age-specific body weights were employed.

The three month exposures for the non-cancer risk-based concentrations are considered to be "subchronic" in nature, and the subchronic Reference Dose was used in the MCP development process, when available. When the subchronic RfD was not available, the chronic RfD was use in its place, an assumption which is conservative (health protective) in nature. As a result of this necessary, conservative practice, an inconsistency occasionally developed where concentrations derived for the subchronic S-3 exposure were less than (approximately a factor of 2) the allowable chronic exposure identified for the S-2 risk concentrations. (In other words, you could work on the soil for 27 years but you could not spend three months working in the soil). In these limited number of cases, the S-3 risk value was set equal to the S-2 risk value. S-2 ceiling values would also apply in these cases (i.e. where the S-2 ceiling value exceeds the S-3 risk value).

3.1.2.4 Risk Assessment Equations

Incidental ingestion of and dermal contact with surface soils and dust, have been identified in the MCP approach as potential exposures of concern for both children and adults in the development of the soil standards. The receptor's exposure to contaminated soil and dust varies according to the activities by which the receptor comes into contact with the soil.

The exposure rate normalized to bodyweight is most often the expression of exposure which is of most toxicological significance. This concept is particularly important in the assessment of direct soil contact because the soil exposure rate normalized to bodyweight is not constant over the lifetime, but rather is relatively high in young children and falls off to a lower, fairly constant level in adults.

In developing the standards, chemical exposures were treated as a function of the concentration of a chemical parameter (referred to as oil or hazardous waste [OHM] in the MCP background document) in soil and the average soil exposure rate normalized to bodyweight for various exposure durations and receptor age groups. The concentrations of chemical parameters were assumed to remain constant in soil over time. As described below, the soil ingestion rates and soil dermal contact rates used here incorporate the frequency and duration of exposure and the appropriate averaging period.

The equation used to develop risk-based concentrations considering potential non-carcinogenic effects associated with direct contact with contaminated surface soil is given as:

$$[OHM]_{soil} = \frac{0.2 \times RfD \times C}{(NADSIR \times RAF_1) + (NADSCR \times RAF_2)} \tag{1}$$

The equation used to develop risk-based concentrations considering potential carcinogenic effects associated with direct contact exposure with contaminated surface soil is given as:

$$[OHM]_{soil} = \frac{ELCR \times C}{((NLADSIR \times RAF_3) + (NLADSCR \times RAF_4)) \times CSF} \tag{2}$$

Where:

$[OHM]_{soil}$ = A risk-based (non-cancer or cancer risk) concentration, in soil, for the oil or hazardous material. In units: mg/kg.
0.2 = A 20% Source Allocation Factor, used to insure that only 20% of an allowable daily intake of the oil or hazardous material may come from exposure to the site soil.
RfD = The oral Reference Dose or substitute toxicity value identified for the oil or hazardous material. In units of: mg/kg/day.
C = Units Conversion Factor: 10^6 mg/kg
NADSIR = The Normalized Average Daily Soil Ingestion Rate (normalized to bodyweight) for the exposure period of concern. (Table 1) These values are rates of soil ingestion (not rates of OHM ingestion). In units: mg_{soil}/kg/day.
NADSCR = The Normalized Average Daily Soil Dermal Contact Rate (normalized to bodyweight) for the exposure period of concern. (Table 1) These values are rates of soil contact (not contact with OHM). In units: mg_{soil}/kg/day.
RAF = The Relative Absorption Factors for soil ingestion or dermal contact and threshold or cancer health effects (a chemical-, medium-, route- , and health endpoint-specific value). Dimensionless.
ELCR = Target Excess Lifetime Cancer Risk: 1×10^{-6} (dimensionless).
NLADSIR = Time-weighted Normalized Lifetime Average Daily Soil Ingestion Rate (normalized to bodyweight). (Table 1) This value represents the exposure during the exposure period averaged over a lifetime, not a lifetime exposure. In units: mg_{soil}/kg/day.

NLADSCR = Time-weighted Normalized Lifetime Average Daily Soil Dermal Contact Rate (normalized to bodyweight). (Table 1) This value represents the exposure during the exposure period averaged over a lifetime, not a lifetime exposure. In units: mg_{soil}/kg/day.
CSF = The oral Cancer Slope Factor for the oil or hazardous material. In units of: $(mg/kg/day)^{-1}$

The Normalized Average Daily Soil Ingestion Rate, (NADSIR) and the Normalized Average Daily Soil Contact Rate (NADSCR) were used to calculate the non-cancer risk-based concentrations. The Normalized Lifetime Average Daily Soil Ingestion Rates (NLADSIR) and the Normalized Lifetime Average Daily Soil Contact Rates (NLADSCR) are used to calculate the cancer risk-based concentrations. The numerical value for each of these soil exposure rates and for each of the soil Categories is shown in Table 1. Appendices A-C of the MCP background document provide the step-by-step derivation of the soil ingestion rates and the soil dermal contact rates summarized in Table 1. The average exposure rates can be reproduced from the information in these tables and the references cited. All of these exposure rates are based on a methodology described in the Massachusetts Department of Environment report entitled "DRAFT Development of Soil Advisory Levels, Technical Support Document (MADEP, 1991a)".

TABLE 1: Summary of Soil Ingestion and Dermal Contact Rates

SUMMARY OF SOIL INGESTION AND DERMAL CONTACT RATES

NON-CANCER EFFECTS

Soil Category	Normalized (to BW) Average Daily Soil Ingestion Rate (NADSIR) mg_{soil}/kg/day	Normalized (to BW) Average Daily Soil/Skin Contact Rate (NADSCR) mg_{soil}/kg/day
S-1	3.1	28.5
S-2	0.29	15.2
S-3	0.63	32.5

NON-THRESHOLD (CARCINOGENIC) EFFECTS

Soil Category	Normalized (to BW) Lifetime Average Daily Soil Ingestion Rate (NLADSIR) mg_{soil}/kg/day	Normalized (to BW) Lifetime Average Daily Soil/Skin Contact Rate (NLADSCR) mg_{soil}/kg/day
S-1	0.41	7.3
S-2	0.11	5.48
S-3	0.029	1.5

The derivations of these values are presented in appendices A (S-1), B (S-2) and C (S-3) of the Massachusetts background document (MOEE Appendix B.5)

3.1.2.5 Allocation of S-1, S-2 and S-3 Soil Categories to Ontario Soil Remediation Categories

The allocation of the Massachusetts S-1, S-2 and S-3 soil categories to the various MOEE land use and depth categories, is summarized in Figure 2. As the S-1 soil category addresses sensitive uses of a site, such as a child receptor having direct contact with contaminated soil, it was decided that the S-1 soil category should apply to agricultural and residential/parkland full depth restoration. For stratified restoration, the S-1 soil category would apply to surface soil (0-1.5 m depth) in the residential/parkland land use category because of the potentially high frequency and/or intensity of exposure of both children and adults to the soil.

The S-2 soil category was based on an exposure scenario for potential adult receptors coming in contact with contaminated soil in a work environment and where any exposure to children would be low in frequency and in intensity. For these reasons, the S-2 soil category was applied to the remediation of surface soil (0-1.5 m depth) in the industrial/commercial land use category. The S-2 soil category was also applied to the sub-surface soil (>1.5 m depth) in the residential/parkland land use category because soil at depth is potentially less accessible to both child and adult receptors in a residential scenario or recreational setting.

The S-3 soil category applies to soil with limited potential for exposure to adults such as exposure during excavation work. Therefore, the S-3 soil category was applied to the restoration of sub-surface soil (>1.5 m depth) in the industrial/commercial land use category.

Figure 2: FITTING ONTARIO LANDUSE/SOIL DEPTH CATEGORIES TO MASS. SOIL CATEGORIES MATRIX
OF HUMAN EXPOSURE POTENTIAL

ACCESSIBILITY OF SOIL	RECEPTOR CHARACTERISTICS							
	CHILDREN PRESENT				ADULTS PRESENT			
	HIGH FREQUENCY		LOW FREQUENCY		HIGH FREQUENCY		LOW FREQUENCY	
	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity	High Intensity	Low Intensity
MASS. ACCESSIBLE SOIL (0 - 0.9m) **ONTARIO SURFACE SOIL (0-1.5m)**	S-1	S-1 **(R/P)** Surface	S-1	S-2 **(I/C)** surface	S-1 **(R/P)** surface	S-2	S-2 **(I/C)** Surface	S-3
MASS. POTENTIALLY ACCESSIBLE SOIL (0.9 - 4.6m) **ONTARIO SUB-SURFACE SOIL (>1.5m)**	S-1	S-2 **(R/P)** sub-surface	S-2	S-3 **(I/C)** sub-surface	S-2 **(R/P)** sub-surface	S-3	S-3 **(I/C)** Sub-surface	S-3
MASS. ISOLATED SUB-SURFACE SOIL (> 4.6m)	S-3				S-3			

R/P = Residential/Parkland, I/C = Industrial/Commercial

3.1.3 MCP Groundwater Categories

Groundwater categories were developed to address three major pathways of exposure to human and environmental receptors. The first category (GW-1) considers protection of groundwater which is a current or future drinking water supply. The second category (GW-2) addresses the potential for volatile contaminants to migrate from groundwater through soil into indoor air. The third category (GW-3) concerns the potential for environmental aquatic impacts when contaminated groundwater discharges to surface water bodies.

3.1.3.1 GW-1 Groundwater Category

Standard toxicity information and risk assessment was used to identify risk-based concentrations associated with a) 20% of allowable daily intake (based on non-cancer health effects), and b) an excess lifetime cancer risk equal to one-in-one million. A lifetime of water consumption at a rate of 2 litres/day (USEPA) is assumed in developing the risk-based concentrations. An average body weight of 70 kg. (USEPA) is also assumed. The lower of the two risk values is then carried through the criteria development process.

The MCP background document provides the risk assessment equations and exposure parameters used by the Massachusetts DEP in calculating the various GW-1 risk values.

The equation used to identify a non-cancer risk-based concentration in drinking water is given as follows:

$$[OHM]_{dw} = \frac{0.2 \times RfD \times BW \times AP \times C}{VI \times RAF \times F \times D1 \times D2} \qquad (3)$$

simplified to:

$$[OHM]_{dw} = \frac{7{,}000 \times RfD}{RAF} \qquad (4)$$

The equation used to evaluate potential carcinogenic effects associated with exposure to contaminated drinking water is given as:

$$[OHM]_{dw} = \frac{ELCR \times BW \times AP \times C}{VI \times RAF \times F \times D1 \times D2 \times CSF} \qquad (5)$$

simplified to:

$$[OHM]_{dw} = \frac{0.035}{CSF\ x\ RAF} \tag{6}$$

Where:

$[OHM]_{dw}$ = A risk-based (non-cancer or cancer risk) concentration, in drinking water, for the oil of hazardous material. In units: µg/liter.
0.2 = A 20% Source Allocation Factor, used to insure that only 20% of an allowable daily intake of the oil or hazardous material may come from the ingestion of drinking water.
RfD = The oral Reference Dose or substitute toxicity value identified for the oil or hazardous material. In units of: mg/kg/day.
BW = The receptor's Body Weight: 70 kg.
D2 and AP = The Duration (D2) of the exposure period and the Averaging Period (AP). For the purposes of setting a MCP GW-1 standard, the drinking water exposures are assumed to occur over the receptor's lifetime: D2 = 70 years, AP = 70 years. The quotient of these two terms is equal to 1 and is dimensionless.
C = Units Conversion Factor: 10^3 µg/mg.
VI = Daily volume of drinking water ingested by the receptor of concern: 2 litres/day.
RAF = The Relative Absorption Factor for drinking water ingestion (A chemical- , route-, and health-endpoint- specific value). Dimensionless.
F and D1 = The Frequency (F) of exposure and the Duration (D1) of each exposure event. The receptors are assumed to be exposed to the drinking water each and every day, and that exposure occurs over the course of the day. F = 1 event/day and D1 = 1 day/event. The product of these terms is equal to 1, and it is dimensionless.
ELCR = Target Excess Lifetime Cancer Risk: one-in-one million, or 1×10^{-6} (dimensionless).
CSF = The oral Cancer Slope Factor for the oil or hazardous material. In units of: $(mg/kg/day)^{-1}$

If for a contaminant, there exists a Massachusetts drinking water standard (MMCL) or a guideline developed by the Massachusetts Department of Environmental Protection, Office of Research and Standards, Division of Water Supply (ORSGL), then this value is adopted as the GW-1 criterion

3.1.3.2 GW-2 Groundwater Category

The MCP GW-2 category applies to groundwater which is considered both shallow and where there is currently (or planned for the near future) a structure built on the land above the groundwater. Standard toxicity information and risk assessment is used to identify risk-based indoor air concentrations associated with a) 20% of an allowable daily exposure (based on non-cancer health effects), and b) an excess lifetime cancer risk equal to one-in-one million. The lower of these two values is identified.

The equation used to identify a non-cancer risk-based concentration in indoor air is given as:

$$[OHM]_{air} = 0.2 \: x \: RfC \qquad (7)$$

The equation used to evaluate potential carcinogenic effects associated with exposure to contaminated indoor air is given as:

$$[OHM]_{air} = \frac{10^{-6}}{UR_{air}} \qquad (8)$$

Where:

$[OHM]_{air}$ = A risk-based (non-cancer or cancer risk) concentration, in indoor air, for the oil of hazardous material. In units: $\mu g/m^3$.

0.2 = A 20% Source Allocation Factor, used to insure that only 20% of an allowable daily exposure of the oil or hazardous material may come from the inhalation pathway.

RfC = The inhalation Reference Concentration or substitute toxicity value identified for the oil or hazardous material. In units of: $\mu g/m^3$.

10^{-6} = Target Excess Lifetime Cancer Risk of one-in-one million (dimensionless).

UR_{air} = The inhalation Unit Risk for the oil or hazardous material. In units of: $(\mu g/m^3)^{-1}$

3.1.3.2.1 Transport Model Equation

The MCP approach employs a vapour transport model to estimate allowable groundwater concentrations which will not result in indoor air concentrations above the risk-based indoor air concentrations calculated above. This model uses an attenuation factor ($5x10^{-4}$) identified by Johnson and Ettinger (1991) in highly permeable soils (i.e. soil permeability K_v equal to $10^{-7}cm^2$). MOEE used this attenuation factor for vapour movement in coarse textured soil situations. For medium/fine textured soils, MOEE used a different attenuation factor ($8x10^{-5}$) also determined by Johnson and Ettinger (1991); i.e. soil permeability (K_v) equal to $10^{-9}cm^2$. Gas migration from the groundwater is assumed to pass through a one metre thick layer of this soil below the floor of the basement. In the derivation of the GW-2 Standards, it is assumed that the receptors of concern are continually exposed to the indoor air under study. The equation used to estimate allowable groundwater concentrations based upon potential indoor air exposure is given as:

$$[OHM]_{gw} = \frac{[OHM]_{air}}{\alpha \, x \, d \, x \, H \, x \, C} \tag{9}$$

Where:

$[OHM]_{air}$ =	The target indoor air concentration, in units of: µg/m^3
$[OHM]_{gw}$ =	The calculated groundwater concentration of the oil or hazardous material which would not result in an indoor air concentration greater than $[OHM]_{air}$. In units of µg/liter
α =	A calculated attenuation factor which relates the indoor air concentration to the concentration in the soil gas directly above the groundwater source: 5×10^{-4}. Dimensionless.
d =	A modification factor to convert theoretical groundwater:soil gas equilibrium concentrations to realistic environmental concentrations. This MADEP value is based upon observations and the professional judgement of MADEP staff. Dimensionless.
H =	Henry's Law Constant, dimensionless form.
C =	Units Conversion Factor, 1000 liter/m^3.

3.1.3.3 GW-3 Groundwater Category

For each contaminant, the lowest environmentally-based U.S. EPA Ambient Water Quality Criterion (AWQCs), from among fresh water acute, marine acute, fresh water chronic and marine chronic values is used in the criteria development process. Each AWQC is based on either a final acute criterion (FAC) or final chronic criterion (FCC) from the U.S. EPA "Gold Book". The Massachusetts DEP reasoned that chemical concentrations present in the groundwater aquifer underlying a clean-up site will undergo a degree of dilution by the time they reach surface water bodies. For this reason, a dilution factor of 10 was applied to the AWQCs in developing GW-3 criteria.

3.1.4 MCP Soil Leaching to Groundwater

The MCP approach considers the potential for a chemical to migrate from contaminated soil to groundwater. This leaching process depends upon a variety of factors which make it difficult to estimate groundwater impacts. In their effort to incorporate this type of protection, the Massachusetts DEP selected a modelling approach utilized by the State of Oregon (Anderson, 1992). It assumes a generic setting for a release of contaminants in the unsaturated zone and then applies a combination of SESOIL and AT123D models to estimate vertical and horizontal transport to ground water. A detailed description of this model and its use as described in Appendix F of the MCP document can be found in Appendix B.5.

3.1.4.1 Leaching Equations

The soil concentrations are calculated using the equations

$$DAF_{OHM} = (6207 \, x \, H_{OHM}) + (0.166 \, x \, Koc_{OHM}) \qquad (10)$$

and

$$[OHM]_{soil} = DAF_{OHM} \; x \; [OHM]_{gw} \; x \; C \qquad (11)$$

Where:

DAF_{OHM} = The Dilution/Attenuation Factor calculated for the oil or hazardous material

H_{OHM} = The Henry's Law Constant for the oil or hazardous material, in units of atm-m^3/mol

Koc_{OHM} = The organic carbon partition coefficient for the oil or hazardous material, in units: ml/g

$[OHM]_{soil}$ = The leaching-based soil concentration, in units: mg/kg.

$[OHM]_{gw}$ = The target groundwater concentration of the oil or hazardous material. In units of µg/liter.

C = Units Conversion factor, 0.001 mg/µg.

These equations were used to derive leaching-based concentrations for each soil category (S-1, S-2, and S-3) to provide soil concentrations protective of the three groundwater categories (GW-1, GW-2 and GW-3). For example, if at a contaminated site, the soil category is S-1, then one of the following categories S-1/GW-1, S-1/GW-2 or S-1/GW-3 is applicable, depending on which of the three groundwater categories is of concern at the site. This also applies to the S-2 and S-3 categories, respectively, resulting in a matrix of nine possible S/GW levels.

3.1.5 MCP Soil and Groundwater Odour Thresholds and Ceiling Concentrations

Odour thresholds were considered by the Massachusetts DEP in the setting of groundwater and soil standards. The odour threshold used in the MCP approach was the concentration at which 50% of the population can detect a compound's odour. Odour thresholds were identified for contaminants in water (ug/L) for the GW-1 standards and for contaminants in air (ug/m^3) for the GW-2 (based on volatilization to indoor air).

A maximum groundwater ceiling concentration was also set at 50,000 ug/L (0.005%) to minimize potential organoleptic (taste and odour) effects on drinking water. This ceiling concentration also provides an absolute upper limit on allowable groundwater contamination to minimize continued degradation of groundwater as a general resource.

For soil, a chemical's "odour index" was identified and used to determine the appropriate ceiling level to be applied in the calculation of the MPC soil standards. The odour index value was determined by dividing a compound's vapour pressure, in Torr at 20-30 degrees Celsius, by its 50 percentile odour recognition threshold (ug/m^3) in air. This provided a relative ranking of a chemical's potential for creating nuisance conditions due to the odour of the volatilized chemical. Ceiling concentrations for soil, based on odour, were applied in the development of soil standards in the S-1, S-2 and S-3 soil categories as shown in Table 2.

Table 2: S-1, S-2 and S-3 Ceiling Values for Soils.

Soil Category	Criteria	Ceiling Value Adopted
Category S-1	Odour Index is $\geq$ 100 or Vapour Pressure $\geq$ 1 Torr	100 ug/g
	0.1 $\leq$ Odour Index $\leq$ 100	500 ug/g
	Odour Index $\leq$ 0.1	1000 ug/g
Category S-2	Odour Index is $\geq$ 100 or Vapour Pressure $\geq$ 1 Torr	500 ug/g
	0.1 $\leq$ Odour Index $\leq$ 100	1000 ug/g
	Odour Index $\leq$ 0.1	2500 ug/g
Category S-3	Vapour Pressure $\geq$ Torr	500 ug/g
	Odour Index $\geq$ 100	1000 ug/g
	0.1 $\leq$ Odour Index $\leq$ 100	2500 ug/g
	Odour Index $\leq$ 0.1	5000 ug/g

3.1.6 MCP Consideration of PQL, Background, Solubility and Odour Threshold

Analytical method detection limits, background concentrations in soil, groundwater and indoor air, chemical solubility in water, and odour detection thresholds, are all considered in the process to develop criteria in the MCP approach for criteria development.

3.1.6.1 Practical Quantitation Limits

Practical Quantitation Limits (PQLs) are used for each chemical. This is the lowest quantitation level of a chemical that can be achieved with reliability among laboratories within the specific limits of precision and accuracy for a given analytical method. It is noted in the method that these PQLs are not the lowest detectable concentrations. They are three to ten times higher than the method detection limit (MDL), the lowest detectable concentration. The specific methodology for selecting the appropriate PQLs is described in Appendix G of the MCP document (Appendix B.5).

3.1.6.2 Background Soil, Groundwater and Indoor Air Concentrations

In developing standards, the Massachusetts DEP made the decision that if background levels prevented achievement of "no significant risk" then attaining background levels may be accepted as a permanent remediation solution. The department determined that standards would not be set at a level less than an established background concentration.

The background levels for soil, groundwater and indoor air utilized in the MCP approach are shown in Table 3-1 of the MPC document (Appendix B.5). These background concentrations were chosen to represent concentrations consistent with the majority of "natural" background conditions and range from the 75th to 95th percentile values of the data sets examined, where information was available.

3.1.6.3 Solubility

The solubility of each organic chemical was considered in the development of the MCP groundwater standards. However, solubility was not considered for any of the metals due to compound-dependent variability. For the organic chemicals, if the calculated allowable level (based on risk) was higher than what could be expected in groundwater, based on the organic contaminant's solubility in water, then a value of one-half the solubility was adopted as the standard. The value of 50% solubility was chosen due to DEP staff concerns that concentrations at or very near a chemical's solubility indicated the presence of a continued source of release of that chemical to the environment. The solubility values are listed in Table 3-1 of the attached MPC document (Appendix B.5).

3.2 Development of Ontario's Soil and Groundwater Criteria.

To develop effects-based soil and groundwater criteria for Ontario, MOEE modified the MCP approach, and also integrated effects-based criteria from other selected jurisdictions. Because Massachusetts used input variables specific to Massachusetts' conditions, it was possible to tailor the MCP approach by substituting input variables that were more relevant to the Ontario situation. A decision also was made to modify the overall manner in which the MCP soil and groundwater criteria were incorporated into the various soil and groundwater categories chosen for use in Ontario. This involved incorporating ecological protection, protection for off-gassing from surface soils, vapour migration from soil to indoor air (in addition to vapour migration via the groundwater pathway) for both coarse textured and medium/fine textured soils, and substituting MCP criteria with risk-based criteria developed in Ontario or other Canadian jurisdictions. This section is divided into four sub-sections describing all of the modifications and application decisions that were made by MOEE.

3.2.1 Modifications to Input Variables in the MCP Approach

3.2.1.1 Method Detection Limits (MDLs)

MOEE analytical method detection limits were used in calculations, where possible, in place of the Massachusetts PQLs, to more accurately represent the Ontario situation. The MDL represents a concentration at which the analyst is confident that the specific compound is present in a soil or water sample. Massachusetts PQLs were used where no Ontario values were available. The Method Detection Limit was derived by the MOEE scientific staff from the Laboratory Services Branch (LSB) and is an estimate that is realistically attainable, based on documented method performance and /or consultation with other laboratories. The MDL is a statistically defined decision point such that measured results falling at or above this point are interpreted to indicate the presence of an analyte in the sample with a specified probability, and assumes that there are no known sources of error in identification or biases in measurement. The procedure to derive an MDL is explained in Appendix A of the MOEE document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario" (1996).

In the case of groundwater, MDLs for drinking water objectives were utilized. Ontario Municipal/Industrial Strategy for Abatement (MISA)/Effluent MDLs were used where drinking water MDLs were unavailable.

3.2.1.2 Ontario Soil/Groundwater/Indoor Air Background Concentrations

For this guideline, rural and urban parkland Ontario Typical Range (OTR_{98}) values were used as the Ontario soil background concentrations in place of Massachusetts' background values. In 1991, MOEE initiated a program for the development of a set of background criteria, referred to as Ontario Typical Ranges, which represent the expected distribution of chemical concentrations resulting from natural geological processes and normal human activity of concentrations of chemicals in surface soil or other receptor types from land use categories in Ontario, remote from the influences of known point sources of emissions. For soils, the OTRs assume a given range of expected chemical concentrations for each land use category.

These ranges are based on the analytical data from pre-defined sampling, processing and analytical protocols. Complete details on the OTR development process can be found in the Phytotoxicology Section report entitled "Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags and Snow" (MOEE, 1993).

In addition, an upper limit, or action level, referred to as the OTR_{98} was developed. This value represents 97.5% (98%) of data in the OTR distribution. From a statistical aspect, this is equivalent to the mean plus two standard deviations of a normally distributed population.

A review of the OTR database indicated that a high degree of sampling variability can occur at any given site when concentrations are at background levels, especially when sampling for organic contaminants. Therefore, replicate sampling would be necessary to address variability due to sampling, as well as analytical variability. In order to minimize costly replicate sampling and analysis to proponents in situations where there is little or no danger of effects, the committee decided to set soil background concentrations at a value equal to the OTR_{98} plus two coefficients of variation ($OTR_{98}+2CV_{ws}$).

The coefficient of variation, referred to is the average "within site" sampling variability around the OTR_{98} , expressed as a percent coefficient of variability (CV_{ws}). This is calculated by taking the average of the "within site" CV's of all points between the OTR_{98} upper and lower confidence limits (MOEE, 1993). The percent value of $2CV_{ws}$ is converted to an absolute value and added to the OTR_{98} value. If the chemical concentration in a single sample is above the (OTR_{98} $+2CV_{ws}$) value, one can be certain (97.5% confidence) that the OTR_{98} has been exceeded for that chemical.

Rural parkland OTR_{98} values were the basis for soil background concentrations for the agricultural land use category while urban parkland OTR_{98} values were the basis for the other land use categories. The term "urban" is defined here as any property that lies within an area that is fully serviced by both municipal water and sewage systems.

For the chemical parameter DDT, the addition of 2 CV_{ws} to the urban parkland OTR_{98} takes the resulting soil background concentration above the corresponding risk-based human health effects concentration calculated in the MCP Method 1 Standards approach. In the case of arsenic, the addition of $2CV_{ws}$ to the urban parkland OTR_{98} results in a soil background concentration which exceeds the MOEE residential/parkland terrestrial effects-based criterion. Therefore, for these two contaminants, the soil background value was limited to the OTR_{98} value in the criteria development process. All Ontario soil background concentrations are shown in Table F (Appendix A.1.6)

The Massachusetts DEP utilized state background groundwater concentrations where they had the information available (for eight chemicals). Similar background data was not available for Ontario groundwater, and because the guideline allows for comparison with up-gradient groundwater quality, the decision was made to drop groundwater background values completely from the generic criteria development process. Background values for indoor air were adopted from the Massachusetts DEP because Ontario values were not available. The Massachusetts values were judged to be consistent with those in the literature.

3.2.1.3 Derivation of S-1, S-2 and S-3 Direct Contact Soil Concentrations for PAHs

In the MCP approach, the USEPA Carcinogenic Potency Value (Unit Risk) of 7.3/mg/kg-day (from IRIS) was applied to the cancer risk calculations for benzo[a]pyrene (B[a]P), as well as seven other PAHs in the chemical parameter list. The resulting direct contact S1, S2 and S3 soil concentrations (e.g. 0.07 ug/g for S1, 0.11 ug/g for S2 and 0.42 ug/g for S3) derived for B[a]P and the other PAH compounds were within the range of method detection limits and Ontario Typical Range levels for rural parkland . MOEE is currently conducting a multi-media assessment of several PAHs. Our current knowledge of PAHs indicates that the health-based criteria derived by Massachusetts for PAHs are more conservative than is necessary in the Ontario situation.

The B[a]P criterion (1.2 ug/g), derived by the Interministry Committee on Clean-up Criteria for the Shell, Oakville and Texaco, Port Credit, refinery properties, was adopted as the S-1 concentration for B[a]P (ICCC, 1988). The relative magnitudes between the S-1, S-2 and S-3 concentrations determined for B[a]P by Massachusetts' Method 1 approach (i.e. 0.07 ug/g, 0.11 ug/g, and 0.42 ug/g) were maintained. By ratio calculation, the S-2 and S-3 concentrations for B[a]P became 1.9 ug/g and 7.2 ug/g respectively.

The MOEE Standards Development Branch (SDB) has proposed an interim classification of some PAHs according to their estimated carcinogenicity potency relative to B[a]P (refer to Table 3). Dibenz(a,h)anthracene has been estimated to have the same potency as B[a]P. The compounds in category #2 are known to be carcinogens and compounds with demonstrated and potentially significant toxicity at other endpoints. Weak carcinogens are listed in category #3. Compounds in category #4 are inactive in carcinogenicity tests or are unlikely to be carcinogenic by the same mechanism as PAHs which are known carcinogens such as B[a]P. Category #4 also includes PAHs for which no data were found to suggest that they are carcinogenic. No data were found for compounds in category #5.

For each of the carcinogenic PAH compounds (in category #1, 2 or 3), the S-1 base-level soil concentration was determined by multiplying its estimated relative potency to B[a]P by the adopted S-1 concentration for B[a]P. S-2 and S-3 base-level soil concentrations for these PAHs were determined in the same way.

Table 3: Cancer Potency of PAHs Relative to Benzo(a)pyrene

Category	Compound	Description	Estimated Relative Potency to B[a]P
1	Benzo(a)pyrene Dibenzo(a,h)anthracene	Potent carcinogen Potent carcinogen	1
2	Benzo(b)fluoranthene Benzo(k)fluoranthene Indeno(1,2,3-cd)pyrene Chrysene	Carcinogen Carcinogen Carcinogen Carcinogen	0.1
3	Benzo(a)anthracene Benzo(ghi)perylene Phenanthrene	Weak Carcinogen Weak Carcinogen Very Weak Carcinogen	0.01
4	Naphthalene 2-methyl naphthalene Anthracene Pyrene Fluorene Fluoranthene Perylene	Not carcinogenic. Not a potent toxicant. Cannot form diol-epoxides, the proximal carcinogens of classical PAH. Not carcinogenic Not carcinogenic Not carcinogenic Not carcinogenic Not carcinogenic	0.0
5	Acenaphthalene Acenaphthylene	No data found No data found	?

Therefore, for each PAH, the soil criteria development process was carried out by comparing the S-1, S-2 and S-3 direct contact soil concentrations (modified for the Ontario situation) with their corresponding leaching-based concentrations, which were derived using the MPC approach to determine the potential for a chemical to migrate from contaminated soil to groundwater; i.e. leaching-based concentrations were determined for each soil category (S-1, S-2, and S-3) to provide soil concentrations protective of the three groundwater categories (GW-1, GW-2 and GW-3).

3.2.1.4 Ontario Drinking Water Objectives (ODWOs)

The MCP approach adopts as a GW-1 value, all state drinking water standards (MMCL) or guidelines developed by the DEP, Office of Research and Standards (ORSGL). The committee decided that it would be more appropriate in the Ontario situation to replace all Massachusetts standards and guidelines, as well as risk-based concentrations with Ontario Drinking Water Objectives (ODWOs).

3.2.1.5 Ambient Water Quality Criteria

The MCP approach utilized the lower value of either freshwater or marine-based (acute or chronic) U.S. EPA ambient water quality criteria (AWQC) in their development of GW-3 concentrations. The committee felt that for the general use of this policy, the marine criteria were not appropriate for the Ontario situation (sites located in the immediate vicinity of Hudson's and James' Bay excepted). Therefore, only fresh water AWQCs were used in the development of GW-3 concentrations in this policy. For contaminants, for which a USEPA fresh water AWQC was unavailable, a substitute "effects-based" value was required.

Ontario Provincial Water Quality Objectives (PWQO), which are based on pristine conditions, were not considered appropriate for a guideline dealing with the remediation of contaminated sites. It was agreed that a more appropriate substitute value is the acute or chronic freshwater species' lowest observable effects level (LOEL). Therefore, fresh water LOELs were substituted into the criteria development process.

MOEE staff obtained all LOELs from the Aquatic Information and Retrieval System (AQUIRE) database. All AWQC and LOEL data (with references) used in the criteria development process can be found in Appendix B.4.

No LOEL was found in the AQUIRE database for total dioxin/furans (TEQ). Aquatic effects data were only available for the isomers T4CDF and TC4DD. Therefore a GW-3 value for total dioxin/furans (TEQ) could not be calculated. For this reason, the GW-1 value (ODWO) was used for determining both the potable and the non-potable groundwater criteria in this guideline.

3.2.1.6 Ceiling Values

Massachusetts ceiling values, based on either health risk or odour, were adopted for soil and groundwater categories in the development of the MOEE criteria.

3.2.2 Summary of the Criteria Components Developed via the Modified MCP Approach

The MPC uses decision trees as a decision making process for deriving soil remediation criteria. Each step of this process involves using established values for prescribed variables, which reflect the pathways and receptors of concern, then selecting from those variables the values which are highest or lowest, for comparison to other variables in the next step of the decision tree. No major changes were made in the MCP decision tree approach; however, because of our incorporation of additional pathways and receptors, a decision was made to simplify the decision tree process that had been utilized by Massachusetts. This involved partitioning out the limiting factors, such as detection limits, background concentrations, etc.

3.2.2.1 Modified Process to Derive S-1, S-2 and S-3 Soil Criteria Components

The modified decision tree process to derive an S-1, S-2, or S-3 risk-based soil contact criterion for each chemical involved the following steps:

1) The non-cancer and cancer risk based concentrations were identified for the given contaminant.

2) The lower of these two values was identified as the S-1, S-2 and S-3 component value.

3.2.2.2 Modified Process to Derive GW-1, GW-2 and GW-3 Groundwater Criteria Components

As in the case of the soil categories, a modified version of the MCP approach was utilized to derive the GW-1, GW-2 and GW-3 groundwater criteria for each contaminant. The modified decision tree process for each groundwater category is summarized in a step by step description below.

GW-1 Groundwater Component

The steps in the modified process to derive GW-1 groundwater category criteria were as follows:

1) If a drinking water standard or guideline (ODWO/MMCL/ORSGL) exists, it was adopted as the GW-1 groundwater standard.

2) The non-cancer and cancer risk based concentrations, and the 50% odour recognition threshold, were identified for the given contaminant and the lowest of these three values was identified as the GW-1 component.

GW-2 Groundwater Component

The steps in the modified process to derive GW-2 groundwater category were as follows:

1) The non-cancer and cancer risk-based indoor air concentrations, and the 50% odour threshold, were identified for the given contaminant and the lowest of these three values was carried through to the next step in the process.

2) If data were available, the indoor air background concentration was identified.

3) The higher of the two values from steps 1 and 2 was carried through to the next step in the process.

4) The vapour transport model (eq. 9) was carried out using the indoor air concentration from step 3 and the result was identified as the GW-2 component.

GW-3 Groundwater Component

The steps in the modified process to derive GW-3 groundwater category standards were as follows:

1) The lowest fresh water ecologically-based U.S. EPA AWQC or AQUIRE LOEL was identified for the chemical.

2) The above value was multiplied by a dilution factor of 10 to yield a groundwater concentration which was identified as the GW-3 component.

3.2.2.3 Modified Process to Derive Soil to Groundwater Leaching-Based Soil Criteria Components

The process to derive S-1, S-2 or S-3 soil leaching-based criteria (a soil concentration which is protective of the applicable groundwater criteria for GW-1, GW-2, or GW-3) is as follows:

1) The leaching-based soil component protective of the applicable groundwater components (e.g. GW-1, GW-2 or GW-3) was derived using equation 11.

3.2.3 Additional Soil Criteria Components Incorporated by MOEE

3.2.3.1 Terrestrial Ecological Soil Criteria Component

The MCP approach addresses primarily human-health effects with some consideration of indirect ecological effects (aquatic) through the soil/groundwater leaching-based concentrations (GW-3). However, there is no consideration for direct soil contact exposure for terrestrial ecological receptors. As MOEE is also committed to providing ecological protection, ecotoxicity criteria were included in the development process for soil criteria. Ontario ecological effects-based criteria for inorganics were incorporated into the process to develop surface restoration criteria for soils. The decision was made that terrestrial ecological protection for direct contact below the 1.5 meter depth, was not appropriate. Therefore, only human health and indirect ecological effects through leaching (via groundwater to surface water) were considered for sub-surface soil criteria (>1.5m depth).

The Netherlands have also developed ecosystem toxicity-based soil criteria for several inorganic and organic contaminants. These concentrations were utilized in the process when Ontario ecological criteria did not already exist. The Massachusetts DEP developed soil and groundwater criteria (based on human health) for 106 inorganic and organic chemicals. The integration of additional criteria for metals and inorganic parameters, based on ecological data, increased the soil chemical list to 115.

The following inorganic parameters were added to the soil criteria development process: barium, boron, chromium (total), cobalt, copper, molybdenum, electrical conductivity (mS/cm), nitrogen (total), and sodium absorption ratio (SAR).

The Massachusetts DEP chose to develop a human health risk-based criterion for chromium III and VI but not for total chromium. MOEE has ecological effects-based criteria for total chromium. Therefore, the committee decided to include total chromium on the chemical list.

The Phytotoxicology Section of the MOEE Standards Development Branch has recently developed soil quality criteria for boron based on phytotoxicity effects data. Boron has been included in the chemical list; however, the boron criteria, which address the 'available' boron in soil are based on a 'hot water extract' rather than bulk soil analysis. The development of the boron criteria is described in detail in Appendix B.3.

3.2.3.1.1 Exposure Pathways and Protection of Ecological Receptors at Various Land Uses

In determining numerical criteria for soil based on potential ecological effects, it was necessary to make judgements as to what receptors should be protected and what level of protection was required for each land use category. A full range of philosophies exist, from protection against the earliest detectable effects to any species that could potentially occur on a site, or be affected by contamination at a site, to protection against the most severe of effects to very common species which normally occur on sites of a particular land use category. The philosophy that is adopted can, therefore, strongly influence the final generic criteria derived. This section outlines the level of ecological protection which forms the basis for the development of the ecological criteria for each of the three land use categories: agricultural, residential/parkland and industrial/commercial.

To the extent permitted by available scientific evidence, these types of protection were incorporated into the criteria development process for each land use category. However, it must be stressed that in many cases, the lack of scientific evidence prohibited the development of an ecological component.

Agricultural Land Use Category

Soils that are to be used for agricultural purposes should be able to support the growth of a wide range of commercial crops as well as the raising of livestock. Contamination due to anthropogenic activities should not result in noticeable yield reductions of commercial crops that cannot be remedied through normal farming practices. Soil concentrations of chemical parameters also should be sufficiently low that there are no known or suspected adverse impacts on domestic grazing animals, including migratory and transitory wildlife, through both direct soil ingestion or through ingestion of plants grown on the soil. Since soil invertebrates and microorganisms provide important functions for the overall health of a soil, and the plants supported by the soil, these populations should not be adversely affected to the point where functions such as nutrient cycling, soil:root symbiotic relationships and decomposition are significantly reduced or impaired.

A consideration of all of the above factors also must recognize that in certain situations, agricultural chemicals are utilized because they are capable of selective toxicological action against undesirable plants and soil organisms. In these situations, a case specific approach will be necessary in the soil remediation process.

Residential/Parkland Land Use Category

The need for protection of commercial crops in the residential/parkland land use category is not as apparent as for agriculture; nevertheless, the common practice of growing backyard vegetable gardens and allotment gardens results in there being little practical difference between the plant species to be protected at residential sites and those at agricultural sites. Since parkland is included with residential land use in this category, it is also necessary to protect migratory and transitory species that may utilize such sites. The major difference from agricultural sites is that, for residential/parkland sites, the protection of domestic grazing animals such as sheep and cattle is not an important consideration.

Industrial/Commercial Land Use Category

It is not necessary to require as high a degree of protection for on-site ecological receptors at an industrial or commercial site as it is for agricultural or residential/parkland sites. The soil at industrial sites should be capable of supporting the growth of some native and ornamental trees, shrubs and grasses, but, it is not as important to protect against yield or growth reductions to the same extent as for residential and agricultural properties, nor to protect as wide a range of species. Since it would be highly undesirable to have transitory or migratory species being affected by utilizing any specific industrial or commercial property, criteria should be sufficiently protective to prevent such adverse effects on these species.

3.2.3.1.2 Existing MOEE Soil Clean-up/Decommissioning Guidelines (SCUGs)

The rationale on which the 1989 guidelines was based was described in the MOE publication "Soil Clean-up Guidelines for Decommissioning of Industrial Lands: Background and Rationale for Development" (MOE, 1991). This publication has been replaced and relevant information applicable to those parameters that were utilized in the 1995 criteria development process can be found in Appendix B.3.

Soil clean-up criteria were developed for the following parameters: As, Cd, Cr (total), CrVI, Co, Cu, Pb, Hg, Mo, Ni, Se, Ag, Zn, soil pH range, Electrical Conductivity and Sodium Absorption Ratio. However, in the case of Cd, Pb, and Hg, the 1989 criteria were influenced more by human health considerations rather than ecological effects, and accordingly these criteria were discarded (with the exception of Cd for the agricultural land use category).

Re-examination of the rationale for the 1989 ecological criteria indicated that although the process was much less rigorous than the most recent CCME protocol for the development of ecological criteria, it did offer several important features:

- the criteria have been utilized in Ontario for 15 years without any evidence to indicate that protection was not provided

- the criteria have been widely adopted for use in other jurisdictions including the CCME without any evidence of problems

- early evidence from the new CCME process which has been applied to a limited number of parameters indicates that the 1989 ecological criteria are in reasonable agreement with the results from this process

- a thorough review of the available literature combined with an experimental program by the Phytotoxicology Section has confirmed that in the case of copper, the 1989 values are fully in line with values that emerge from this type of analysis

Based on this assessment, a decision was made to incorporate the 1989 ecological criteria. The following additional considerations were utilized.

A strong argument can be made that the 1989 SCUGs for Cd (i.e. 3 ppm for coarse-textured soils and 4 ppm for medium/fine textured soils) are still valid for the agricultural use category. Cd is an element that is not readily eliminated in mammals, and it is known to bioaccumulate in tissue. Grazing animals that are ingesting Cd accumulated in plants growing on contaminated soils and from the soils themselves may be more at risk from Cd accumulation than is accounted for by any criterion higher than the current MOEE SCUG of 3 ppm (e.g. the Netherlands ecotoxicity criterion for Cd is 12 ug/g). It is known that wild ungulates grazing on lands with natural background Cd concentrations can accumulate Cd in the kidneys to the point where the kidneys are unfit for consumption. Some species of food plants (i.e. spinach and lettuce) have been observed to accumulate Cd in the edible portions of the plant to levels that would be of concern, even at relatively low soil Cd concentrations. Although the change of the Cd guideline from 3 µg/g to 12 ug may be suitable for residential purposes, there is little evidence that it takes the above factors into consideration for agricultural land uses.

The CCME draft document "A Protocol for the Derivation of Ecological Effects Based and Human-Health Based Soil Quality Criteria" (1994) contains some equations that are useful for estimating guidelines based on food ingestion and soil ingestion by animals utilizing the land. Using these equations and data presented in the draft CCME assessment document on Cadmium (Canadian Soil Quality Criteria for Contaminated Sites: Cadmium), a guideline of 3 µg Cd/g is indicated to be appropriate for agricultural use. These equations are presented below. For these reasons, it was decided to continue using the 3 µg/g guideline for cadmium for agricultural use unless and until there is substantial justification to indicate that it too should be changed. The following is a CCME calculation of soil quality criteria based on food ingestion by animals (e.g. cattle):

$$\begin{aligned} EDFI &= DTED \times BW/FIR \\ &= 0.0028 \text{ mg Cd kg}^{-1}\text{BW} \times \text{day}^{-1} \times 100\text{kg} / 3\text{kg day}^{-1} \\ &= 0.093 \text{ mg/kg dw food} \end{aligned}$$

$$\begin{aligned} SQC_{fi} &= EDFI \times AF_{fi}/BCF \\ &= 0.093 \text{ mg/kg} \times 0.85/0.025 \\ &= 3.16 \text{ mg/kg} \end{aligned}$$

CCME calculation of soil quality criteria based on soil ingestion by animals

$$\begin{aligned} EDFI &= DTED \times BW/SIR \\ &= 0.0028 \text{ mg Cd kg}^{-1}\text{BW} \times \text{day}^{-1} \times 100\text{kg} / 0.54\text{kg day}^{-1} \\ &= 0.519 \text{ mg/kg dw soil} \end{aligned}$$

$$\begin{aligned} SQC_{si} &= EDSI \times AF_{si}/ BF \\ &= 0.519 \text{ mg/kg} \times 0.18/ 0.025 \\ &= 3.74 \text{ mg/kg} \end{aligned}$$

Where:

SQC_{fi} = Soil Quality Criteria for Food Ingestion
SQC_{si} = Soil Quality Criteria for Soil Ingestion
EDFI = Estimated dose for Food Ingestion
DTED = Daily Threshold Effects Dose
BW = Body Weight
FIR = Food Ingestion Rate
SIR = Soil Ingestion Rate
AF_{fi} = Apportionment factor for Food ingestion
AF_{si} = Apportionment Factor for Soil Ingestion
BCF = Bioconcentration Factor
BF = Bioavailability Factor

The 1989 Cu, Mo, and Se SCUG criteria for agricultural/residential/parkland land uses were developed to protect grazing livestock. The industrial/commercial SCUG criteria for these three parameters provided protection to vegetation only. For this reason, the industrial/commercial SCUG criteria (for coarse-textured and medium-fine textured soils) were selected for both the residential/parkland and industrial/commercial land use categories where grazing animals are not likely to occur. The Cu, Mo and Se SCUG values that were based on protection of grazing livestock will apply to the agricultural land use category only.

The electrical conductivity of soil is essentially a measurement of the total concentration of soluble salts in the soil solution and can have a large osmotic influence on plant growth, as well as on soil organisms. The existing MOEE SCUGs for electrical conductivity (E.C.) of a soil required the use of a saturated extract. This procedure is time consuming and results are subjective; i.e. the end point of saturation is determined by the technician's expert opinion.

A fixed 2:1 water:soil procedure eliminates this uncertainty and provides a more rapid and reliable test. Both MOEE (Phytotoxicology Section) and Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) now use the 2:1 procedure for most routine samples. The water:soil ratio used for the extract affects the resultant electrical conductivity; hence, the existing SCUG of 2.0 mS/cm (agricultural/residential/parkland) and 4.0 mS/cm (commercial/industrial) were adjusted to account for the change in water:soil ratio for this criterion.

Data in Extension Bulletin E-1736 (Michigan State University, 1983) made available to the committee by the Department of Land Resource Science, University of Guelph, show that for a given E.C., in saturation extract, the expected E.C. in a 2:1 water:soil ratio would be one third of the former. The appropriate E.C. for both agricultural and residential/parkland land use categories is 0.667 mS/cm. When rounded to 0.7 mS/cm, this value corresponds with the boundary between what McKeague (1978) states "may result in a slightly stunted condition in most plants" and "slight to severe burning of most plants". This is a reasonable concentration at which to establish the E.C. SCUG and confirmed the use of the divisor of 3 as a conversion factor. Using this conversion factor, the industrial/commercial SCUG for E.C. becomes 1.4 mS/cm.

Provisional soil clean-up guidelines were also produced in 1989 for Sb, Ba, Be and V for which the knowledge of their potential adverse phytotoxic effects was more limited than for the other inorganic parameters. These provisional criteria were also incorporated into the current modified criteria development process.

In all cases, MOE SCUG criteria values for coarse-textured soils, as well as medium and fine textured soils have been adopted from the 1989 guidelines for use in the current criteria development process. Coarse-textured soils are defined here as greater than 70% sand. The medium and fine textured soil SCUGs are 20-25% higher than the corresponding values for coarse-textured soils.

3.2.3.1.3 The Netherlands "C Level" Ecotoxicity Criteria

The Dutch government published soil and groundwater clean up guidelines, "ABC values", in 1983. These guidelines have undergone revision over the last 7 years to include both human health and ecological effects-based data. A new set of C-values has been proposed (Vegter, 1993). The final integrated C-value includes a human health component, as well as the ecological component, and includes risk management adjustments. The ecological component of the C-value is derived by taking the geometric mean or the average value of the logarithm of the No Observable Adverse Effect Concentration (NOEC) (Denneman and van Gestel, 1990). This means that the C-value represents the chemical concentration at which the NOEC for 50% of the ecological species has been exceeded.

For the purposes of this guideline, the ecotoxicity component of the C-value was incorporated into the soil criteria development process in all cases where a 1989 MOE SCUG value was not available. In addition to the references listed above, more information on the Dutch guidelines can be found in the following references: van den Berg and Roels (1993); van den Berg et al. (1993); and Denneman and Robberse (1990).

3.2.3.2 Migration: Soil Vapour to Indoor Air Soil Criteria Component

The MCP approach does not consider the potential for direct migration of volatile contaminants from contaminated soil to indoor air. Volatile organic compounds may exist in soils such that vapours can migrate by diffusion under a concentration gradient or by advection under a pressure gradient directly into underground structures which can create a potential health risk to occupants in the building.

As a result of feed back received during the public consultation process, and in consideration of the fact that the soil-to-indoor air exposure pathway can pose a significant risk to human health, a decision was made to include this pathway as an additional component in the surface soil (≤1.5m depth) criteria development process. Therefore, the soil vapour-to-indoor air (S/IA) pathway was used in the development of the surface soil criteria to provide protection for situations which involve, or might involve the construction of buildings with basements on sites previously contaminated with petroleum products.

Vapour movement from contaminated groundwater through soil and into a basement is dealt with through use of another vapour transport model in the MCP approach. The MCP vapour transport model addresses the potential for vapour migration from soils greater than 1.5 m below surface. Also, at depths greater than 1.5 meters, basement walls, would tend to be associated with larger, commercial or industrial buildings, where wall thickness would normally be much greater than those of typical residential dwellings. Accordingly, additional protection would be afforded occupants in these types of buildings due to much greater indoor air attenuation factors (dilution resulting from vapour migration across the wall and into indoor air).

Accordingly, a set of soil-to-indoor air component concentrations (S/IA) were developed for all volatile organic contaminants for which the MCP approach derived GW-2 concentrations (i.e. 51 organic compounds in the full suite of 117 chemical parameters).

The S/IA soil concentrations were determined using equations adapted from the vapour transport model developed by O'Connor Associates Environmental Inc. for both the CCME and Alberta Environmental Protection's revised remediation guidelines for petroleum storage tank sites (Alta. Envir. Protection, 1994; CCME, 1994; O'Connor Assoc. Envir. Inc., 1993). The S/IA soil concentrations were based on the same target indoor air concentrations derived by Massachusetts for GW-2 concentrations (i.e. human health risk-based air concentrations, odour detection levels or background indoor air concentrations).

3.2.3.2.1 Vapour Transport Model Equations Used to Determine S/IA Soil Concentrations

Volatile organic compounds in soil may exist in pure (immiscible) form or in the dissolved, adsorbed and vapour phases. The distribution of a contaminant between phases depends on the contaminant concentration, soil type, moisture content, porosity and organic carbon fraction. It is also governed by specific physical properties of the contaminant.

The concentration of volatile compounds in the soil gas phase (air), soil water phase (dissolved) and soil particle phase (absorbed) can be estimated by equations in the phase partitioning component of the vapour transport model. The calculations require contaminant properties such as organic carbon partitioning coefficient, Henry's Law constant, as well as certain soil data including temperature and organic carbon fraction. The equations are as follows:

$$C_{sw} = C_{sp} / (K_{oc} \text{ x } f_{oc}) \qquad \text{S/IA Eq. (1)}$$

where: C_{sp} = contaminant concentration absorbed to soil particles (ug/g)
C_{sw} = contaminant concentration dissolved in soil water (ug/ml)
K_{oc} = organic carbon partitioning coefficient (ml/g)
f_{oc} = organic fraction of dry soil (g/g) = 0.001 for this application

$$C_{sg} = (C_{sw} \times H) / R \times T \qquad \text{S/IA Eq. (2)}$$

where: C_{sg} = contaminant concentration in soil gas (ug/m^3)
H = Henry's Law constant (atm.m^3/mol.)
R = Gas Constant (0.082 atm.L/mol.K°)
T = Absolute Temperature (293 °K)

The following equation can be developed from S/IA equations (1) and (2):

$$C_{sp} = C_{sg} \times R \times T \times H^{-1} \times K_{oc} \times f_{oc} \qquad \text{S/IA Eq. (3)}$$

In order to quantify the relationship between soil gas concentration and indoor air concentration, a dilution factor was derived via equations in the "mass transfer to building" component of the model. Therefore, S/IA equation (2) can also be expressed in terms of the target indoor air concentration:

$$C_{sg} = [\text{Indoor Air}] \times D \qquad \text{S/IA Eq. (4)}$$

where: [Indoor Air] = the target indoor air concentration of the contaminant (ug/m^3)
D = dilution factor for the contaminant concentration in the soil gas phase vs the target indoor air concentration.

S/IA equation (3) can then be expressed in terms of the target indoor air concentration:

$$C_{sp} = [\text{Indoor Air}] \times D \times R \times T \times H^{-1} \times K_{oc} \times f_{oc} \qquad \text{S/IA Eq. (5)}$$

The relationship between soil gas concentration and indoor air concentration is a complex function of variables and parameters relating to soil conditions, depth to contamination, building foundation and mechanical system details, meteorological conditions and contaminant properties. In the model, a probabilistic analysis comprised of two parts was conducted to determine dilution factors between C_{sg} and [Indoor Air]. A sensitivity analysis was conducted in which all input variables, except depth to contamination, were assigned probability distributions and were allowed to vary during execution of a Monte Carlo simulation of the vapour transport. This was done to identify the parameters having the greatest influence on the dilution factor.

Then a series of simulations was carried out, allowing the values of only the most significant parameters to be varied, in order to develop dilution factors as a function of depth and soil type. Since the nature of the actual distributions was generally not known, most variables were assigned a triangular distribution defined by minimum, maximum and modal (most probable) values. It was concluded that in the absence of more detailed statistical information or site-specific data, the triangular distribution was appropriate for this study.

At the 5th percentile, there is a 5 percent chance, based on variations in the key parameters, that the dilution factor will overpredict the dilution and hence underpredict the indoor air concentration. This corresponds to a 95 percent level of conservatism. For the most conservative 5th percentile values, the vapour model predicted a dilution factor for sandy soils ranging from approximately 9,500 at zero depth to 31,400 at 10m depth. The 5th percentile range for clayey soils was 12,600 to 388,000, respectively.

Details of the above mentioned analyses, a listing of the input parameters and probability distributions and values assigned to the parameters, and results of the probability analyses for two soil types, sandy and clayey soils (e.g. curves for the 0, 5th, 10th, 25th, 50th, 75, 90th, and 100th percentiles) are presented in the 1994 CCME document entitled "A Protocol for the Derivation of Ecological Effects-Based and Human Health-Based Soil Quality Criteria for Contaminated Sites".

In order to provide maximum protection in the majority of soil types the decision was made that the dilution factor pertaining to the 5th percentile for sandy soil was the most appropriate for this policy. The assumption was also made that the contaminated soil would be in direct contact with a basement foundation (i.e. depth = 0). Therefore, a dilution factor of 10,000 was chosen for determining the S/IA value for coarse textured soils. This value was also used by Alberta Environment for developing their revised MUST guidelines. Thus, S/IA equation (4) can now be written as:

$$C_{sg} = [\text{Indoor Air}] \times 10^4 \text{ (units in ug/m}^3\text{ soil)} \qquad \text{S/IA Eq. (6)}$$

and after making all unit conversions (refer to Appendix B.1.11), S/IA equation (5) becomes:

$$C_{sp} = [\text{Indoor Air}] \times K_{oc} \times H^{-1} \times 2.4 \times 10^{-7} \text{ (units in ug/g soil)} \qquad \text{S/IA Eq. (7)}$$

As in the vapour transport model to determine GW-2 groundwater concentrations that are protective of indoor air, a different dilution factor was used in equation (4) of the model in order to develop the S/IA concentrations for medium/fine textured soils. The vapour transport models used for groundwater to indoor air, and soil to indoor air, are very similar. For this reason, the S/IA dilution factor for medium/fine textured soil was derived from the ratio between the two attenuation factors used in the GW-2 vapour transport model for coarse textured soils (5×10^{-4}) vs. medium/fine textured soils (8×10^{-5}); i.e. the ratio is 6.25. Therefore, for medium/fine textured soils, the dilution factor (D) in eq.(4) of the S/IA vapour transport model was given the value of 6.25×10^4 and a factor of 6.25 was added to eq. (7).

3.2.3.2.2 Derivation of the S/IA Soil-to-Indoor Air Concentration.

The S/IA soil concentration, calculated as above to meet a target indoor air concentration, is based on the total amount of contaminant present on the soil particles. However, in reality, the analysis of volatile organic contaminants in a given volume of soil involves a standard heat and trap process which not only measures the amount of contaminant present on the soil particles, but also the amount of contaminant in the soil gas and dissolved in the soil water. In order to ensure that the soil criterion was consistent with the way that soil is analyzed for volatile organic contaminants, the S/IA soil concentration must be based on the total amount of contaminant present in all three phases of a given volume of soil.

It was first necessary to establish the proportions of a unit volume of sandy soil which consists of particles, soil gas or soil water. Modal values for porosity, moisture content, degree of saturation, particle density and bulk density were selected from their corresponding triangular distributions. The following percent volumes were then calculated based on the above modal inputs:

Portion of soil volume made up by soil particles = 60 %
Portion of soil volume made up by soil gas = 30 %
Portion of soil volume made up of soil water = 10 %

The amount of contaminant present in the soil gas, in the soil water or on the soil particles of a unit volume of soil (ug/cm^3) to meet the target indoor air concentration was calculated using the appropriate S/IA equations (1), (6) and (7). The sum of these amounts was then converted to a soil concentration value (ug/g dry weight of soil) using the modal values for particle density and soil bulk density for sandy soils from the triangular distributions for these parameters. The modal values for sandy soils were 2.65 g/cm^3 and 1.6 g/cm^3, respectively.

The following steps were carried out to derive an S/IA soil concentration (ug/g dry soil) for each volatile organic:

1. The concentration of contaminant absorbed on soil particles which produces the target indoor air concentration was estimated using S/IA equation (7) - units of value in ug/g.

2. The resulting value from S/IA equation (7) x 2.65 ug/cm^3 (particle density) x 0.6 (% soil volume) provides the amount of contaminant absorbed on the soil particle portion of a cm^3 of soil - units of final value in ug/cm^3.

3. The amount of contaminant in the soil gas portion of a cm^3 of soil was determined by solving S/IA equation (6) for the soil gas concentration x 0.3 (% soil volume) x 10^{-6} (unit conversion) - units of final value in ug/cm^3.

4. The amount of contaminant dissolved in the soil water portion of a cm^3 of soil was determined by solving S/IA equation (1) for the soil water concentration x 0.1 (% soil volume) x 10^{-3} (unit conversion) - units of final value in ug/cm^3.

5. The total amount of contaminant in a cm^3 volume of soil is equal to the sum of the values derived in steps 2, 3 and 4 - unit of final value in ug/cm^3.

6. The S/IA concentration (units in ug/g soil dry weight) is equal to the value derived in step 5 divided by 1.6 g/cm^3 (soil bulk density).

3.2.3.2.3 Application of a Degradation/Volatilization Factor to the S/IA Soil Concentration

The CCME/Alberta vapour transport model assumes a constant contaminant source; it does not account for volatilization (loss of contaminant to surface), degradation or source depletion of a contaminant in soil with time (CCME, 1994). Although very protective of human health, the assumption of a constant source concentration may not be realistic when permanent soil remediation criteria are being considered. Due to the highly time-dependent nature of the soil-to-indoor air pathway, the effect of chemical degradation, source depletion due to volatilization and actual thickness of the contaminated zone must be considered when modelling risk to human health resulting from low contaminant levels left in remediated soil. For this reason, the decision was made to apply a degradation/volatilization factor to each S/IA soil concentration generated by the vapour transport equations.

The degradation/volatilization factor was derived from data generated by Sanders and Stern (1994) using a dynamic soil-to-indoor air exposure pathway model developed by Jury *et.al.* (1983, 1990). This model is unique in that it takes into account contaminant losses due to degradation and volatilization to the surface over time. Also, like the S/IA values, it operates on the basis that a volatile organic contaminant is present in the soil in a vapour phase, aqueous phase and adsorbed to soil particles. The Jury *et.al.* model can assume an infinite contamination source or can assume a contaminant source is confined to a layer of soil of finite thickness. Using the Jury *et.al.* model set for infinite contamination depth, with and without contaminant degradation in a hypothetical environmental scenario, Sanders and Stern (1994) determined soil criteria for several volatile organics; benzene, carbon tetrachloride, chloroform, chloromethane and dichloromethane.

The ratios between the soil criteria predicted with and without degradation (from Sanders and Stern, 1994), for the five volatile organics (see Table 4) were examined and a decision was made to take 50% of the mean value of these ratios (which approximates the geometric mean) and to use this as a degradation/volatilzation factor. The value was calculated at 31.

All S/IA concentrations were subsequently adjusted by this "best judgement" factor at this time. However, if more detailed information is made available at a later date then the degradation/volatilization factor may be determined on a chemical by chemical basis. Also, the data generated by Sanders and Stern (1994) pertains to carcinogens for which acceptable exposure is expressed in terms of total life time dose. The degradation/volatilization factor derived from this data was applied to the "threshold" contaminants as well. As with carcinogens, it is unrealistic to assume a constant source for non-carcinogens as well. The S/IA values for all volatile compounds are shown in the final column of the component summary tables presented in Appendex A.2.

Table 4: Jury Model - Infinite Contamination Thickness

	Contaminant Degradation	No Contaminant Degradation	
Volatile Organic	Soil Cleanup Criteria (ug/g)	Soil Cleanup Criteria (ug/g)	Criteria Ratio
Benzene	0.49	0.0031	158
Carbon tetrachloride	0.0032	0.0005	6.5
Chloroform	0.17	0.014	12
Chloromethane	2.1	0.045	47
Dichloromethane	1.1	0.013	85
Mean Value (50% of mean value)			62 (31)

3.2.3.3 Soil Vapour to Outdoor Air Modelling Check for Exceedance of Ontario Ambient Air Quality Criteria

Although the Massachusetts approach provided some protection for soil vapour to outdoor air transfer via the use of ceiling concentrations, additional analysis of vapours from surface soils to outdoor air was warranted. The final step in the soil criteria development ensures that the criteria for volatile contaminants is established such that the air quality is not affected by unacceptable levels of soil vapour migrating to outdoor air. The surface soil criteria for fourteen organic contaminants were examined to ensure that the associated soil vapour concentrations would not exceed Ontario ambient air quality criteria (AAQC).

On the basis of two separate model runs (AERIS and MOEE Toxic Model), by staff of the Air Resources Branch, under a number of worst case soil depth and site characteristic assumptions, there was no indication that ambient air quality would be a problem for any of the surface criteria. A description of the modelling approach that was utilized is shown in Appendix B.3.

3.2.4 Replacement of MCP Human Health Risk-Based Criteria Components with Canadian Values.

The decision was made to choose human health risk-based criteria already derived by the MOEE or other Canadian jurisdictions over those developed by the Massachusetts DEP. In each land use category, MCP risk-based concentrations were replaced with Canadian criteria for lead, dioxin/furans, PCBs, and total petroleum hydrocarbons (TPH). The basis for the substitute criteria is discussed in the following sections.

3.2.4.1 MOEE Dioxin/Furan Soil Criteria

A toxic equivalent (TEQ) approach has been developed by the Standards Development Branch (Joint Consultative Committee of Senior Health and Environmental Ministers, 1989) as a means of expressing the concentration data for 17 specific dioxin/furan isomers of concern as a single number, based on international toxicity equivalency factors (I-TEFs). This approach provides an estimate of the toxicity of the mixture, relative to 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD), the most toxic isomer. Based on this technique, the Standards Development Branch of MOEE has set the interim agricultural soil criterion for dioxin/furans at a TEQ of 0.01 ng/g; the interim residential/parkland soil criterion has been set at a TEQ of 1 ng/g (Birmingham B., pers. comm.).

These criteria were adopted for use in this guideline in their respective land use categories, with no differentiation being made for potable vs. non-potable groundwater nor for surface vs. sub-surface depths. A decision also was made to apply the residential/parkland soil guideline (1 ng/g) in the industrial/commercial category. However, in the case of the industrial/commercial category, no criterion was developed for sub-surface soils (Tables C and D), leaving the option open for the development of an effects-based criterion via the use of risk assessment or criteria adoption.

3.2.4.2 CCME Criteria for PCBs

The decision was made to utilize the interim soil remediation criteria which were developed by the Canadian Council of Ministers of the Environment, with scientific input from MOEE staff (CCME, 1987). Based on this report, the MOEE is currently using the following soil remediation criteria for PCBs; 0.5 ug/g for agricultural land use, 5 ug/g for residential/parkland land use. A risk assessment value of 25 ug/g for industrial/commercial land use is currently being used by MOEE for PCBs. The committee adopted these criteria for this guideline with a similar approach to groundwater and surface categories that was developed for dioxins/furans. Modifications were made for the soil depth categories.

3.2.4.3 MOEE Soil Remediation Criteria for Lead

As part of its regulatory mandate to establish standards for environmental quality, the MOEE Standards Development Branch (SDB) developed multi-media criteria for lead. The committee addressed the risk management and policy issues related to lead and produced a set of recommended lead criteria for air, soil and water. With the public consultation process now complete, these revised lead criteria will replace existing MOEE standards/guidelines. The rationale for these recommendations can be found in a document entitled; "Rationale for the Development of Soil, Drinking Water, and Air Quality Criteria for Lead" (MOEE, 1994).

The recommended soil remediation criteria from this multi-media process have been incorporated into the MOEE's revised soil and groundwater criteria. They are as follows; 200 ug/g for agricultural and residential/parkland sites, and 1000 ug/g for industrial/commercial sites. As with dioxins/furans and PCBs, no differentiation was made between potable and non-potable surface categories; however, modifications were made to the sub-surface categories. In the case of the industrial/commercial land use category, the option will exist for the development of a less stringent sub-surface criterion at a future date.

The SDB recognized that, due to the many historical uses of lead, a residential limit of 200 ppm will be exceeded in many older urban residential areas; however, the committee stressed that the soil criteria are not to be considered as action or trigger values to initiate remediation of contaminated sites; rather, the revised criteria apply in the context of the MOEE's revised guideline. A more thorough discussion of the use of the soil criteria can be found in Section 6 of the new guideline.

3.2.4.4 MOEE Soil Remediation Criteria for Arsenic

The MOEE is currently conducting a multi-media assessment of arsenic. Therefore, it was decided to leave the arsenic criteria at the concentrations in the 1989 MOEE soil remediation guideline until the multi-media assessment is complete.

3.2.4.5 MOEE Interim Guidelines Criteria for Total Petroleum Hydrocarbons

Criteria which were developed for use in the 1993 Interim Guidelines for the Assessment and Management of Petroleum Contaminated Sites in Ontario were adopted for this guideline. These criteria were developed by a multi-stakeholder working group composed of representatives from the Canadian Petroleum Products Institute (CPPI), MOEE branches and regional staff, and Ministry of Consumer and Commercial Relations (MCCR) for use on sites contaminated by petroleum products (primarily gasoline, diesel, and fuel and waste oils) released from underground storage tanks, aboveground storage tanks or lines/pumps at commercial sites. The guidelines specifically refer to contamination from retail and private fuel outlets, bulk plants and terminals but exclude refineries and petrochemical plants.

The interim guidelines used a site sensitivity decision tree process to determine the relative sensitivity (high, moderate or low) of a site followed by the application of the appropriate numerical criteria. The guideline also contained sections on investigation requirements and sampling and analytical protocols.

It is important to note that the interim guidelines workgroup developed criteria for total petroleum hydrocarbons (TPH), which is a measure of all petroleum compounds present in the soil; i.e. volatile, semi-volatile, and non-volatile compounds. Different test methods are required to analyze for different volatiles. TPH can be broken into three groups; TPH (purgable), TPH (cold extractable) and TPH (hot extractable). The first two groups roughly correspond to gasoline and diesel fuels, the third group corresponds to heavy oils. For this reason, rather than having a single criterion for TPH, the lighter petroleum hydrocarbons (gasoline/diesel), which contain the majority of short chained carbon compounds, were separated from the heavier petroleum hydrocarbons (heavy oils) with longer carbon chains.

The petroleum contaminated soils workgroup's Level I, II, and III criteria for TPH were adopted, with some modifications for use in this guideline. For the lighter petroleum hydrocarbons (gasoline/diesel fuel), the Level I interim guideline TPH criterion (100 ppm) applies to the remediation of all surface and sub-surface soils where potable groundwater protection is required. Where groundwater is non-potable, the Level II TPH criterion (1000 ppm) applies to all surface soils in both the residential/parkland and industrial/commercial land use categories for coarse textured soils as well as the residential/parkland land use category for medium/fine textured soils. A value of 2000 ppm (2 x Level II criterion) was selected as the criterion for medium/fine textured soils in the industrial/commercial land use category. In both the potable and non-potable situations, the lighter petroleum hydrocarbon soil concentrations are higher than the combined total of the allowed soil concentrations for the BTEX compounds.

For the lighter petroleum hydrocarbons (gasoline/diesel fuel), the Level III criterion (5000 ppm) applies to coarse textured sub-surface soils in both residential/parkland and industrial/commercial land use categories. A value of 10,000 ppm (2 x Level III criterion) was selected as the criterion for medium/fine textured sub-surface soils in the industrial/commercial land use category. Again, the lighter petroleum hydrocarbon soil concentrations are higher than the combined total of the allowed soil concentrations for the BTEX compounds.

For petroleum hydrocarbons (heavy oils), it was decided that the Level II criterion (1000 ppm) would provide sufficient protection for all potable groundwater situations because most of the volatile compounds are absent from the petroleum hydrocarbons (heavy oil) group. The Level II criterion (1000 ppm) also applies to the residential/parkland category in a non-potable groundwater situation. The Level III criterion (5000 ppm) applies to remediation of coarse textured, surface soils in the industrial/commercial land use category, as well as coarse textured, sub-soils in both the residential/parkland and industrial/commercial land use categories. For sub-surface soils with medium/fine texture, the value of 10,000 ppm (2 x

Level III criterion) applies in the industrial/commercial land use category. This concentration is not expected to adversely affect water movement in soil. The petroleum hydrocarbons (heavy oils) concentrations in soil are higher than the combined total of the allowed soil concentrations for the BTEX compounds.

It should be noted that the ceiling value set by Massachusetts for TPH in potable groundwater (1000 ug/L) was adopted by MOEE as the potable groundwater criterion for both the petroleum hydrocarbon (gasoline/diesel fuel) and petroleum hydrocarbon (heavy oils) groups. There has been no value assigned as a non-potable groundwater criterion.

3.2.5 Other Modifications and Limiting Factors

3.2.5.1 Degeneration of Some Chlorinated Aliphatics to Vinyl Chloride

Reductive dechlorination is the major mechanism for the biotic degradation of some polychlorinated ethylenes. The higher chlorinated aliphatics can be degraded in the absence of oxygen and the presence of anaerobic methane-producing bacteria. Some sub-surface soil and groundwater conditions provide a suitable anaerobic environment for this kind of transformation and such transformation has been observed in the environment (Water and Earth Science Assoc., 1989-90; reviewed in Science Applications International corporation, 1985).

Tetrachloroethylene and trichloroethylene can be transformed anaerobically via sequential dechlorination to vinyl chloride. The chemicals 1,1-dichloroethene, cis- and trans-1,2-dichloroethenes are intermediates (Vogel and McCarty, 1985; Barrio-Lage *et al.* 1986). On the other hand, abiotic reduction of 1,1,1-trichloroethane leads to 1,1-dichloroethene which can be transformed by microorganisms to vinyl chloride (Vogel *et al.* 1987). Though vinyl chloride can be further degraded to ethene or carbon dioxide, the rate of transformation is very slow in comparison to the previous degradation steps (Major *et al.* 1991). If large concentrations of the higher chlorinated aliphatics are allowed to remain in soil and groundwater, their concentrations will decrease in time. Simultaneously, the concentration of vinyl chloride may increase and persist in the anaerobic environment. Vinyl chloride is a known potent human carcinogen (IARC, 1979; US EPA, 1985).

To prevent generation of unacceptable soil and groundwater concentrations of vinyl chloride in a non-potable situation, a decision was made to limit the amount of these higher chlorinated ethylenes in soil and in groundwater. Therefore, for the above-mentioned chlorinated ethylenes, soil and groundwater criteria derived for the protection of potable groundwater; i.e. criteria in Tables A (surface soil - potable groundwater) and C (sub-surface soil - potable groundwater), were applied to Tables B (surface soil - non-potable groundwater) and D (sub-surface soil - non-potable groundwater) respectively.

3.2.5.2 Limited pH Range for Use of Generic Criteria

For most of the inorganic criteria, protection of terrestrial ecological receptors is the most sensitive component. In almost all cases, the experimental studies that were conducted to establish the dose:response relationships utilized soils with normal pH ranges between pH 5.0 to 9.0. It is a well known fact that for many metals, bio-availability in soil increases significantly as soil becomes more acidic. Conversely, some metals become increasingly more mobile at very high soil pH.

It is also recognized that the pH of the soil can impact on the leaching of inorganics from soil to groundwater. In view of these factors, a limitation was placed on the use of the generic criteria derived for inorganics. Since metal mobility and bio-availability increase at high and low pH levels, the generic soil criteria for inorganic parameters are applicable when the pH ranges between 5.0 and 9.0 (surface soils) and 5.0 and 11.0 (sub-surface soils). The soil pH range acceptable for applying generic criteria to sub-surface soils (>1.5m depth) was set at pH 5.0 to 11.0 because pH at depth is naturally higher than at the surface due to higher levels of carbonates.

3.2.6 Summary of the Final Decision Process for the Development of All Ontario Soil and Groundwater Criteria

The input variables and steps used in the decision process for all soil and groundwater remediation criteria for each land use category and groundwater situation, are summarized in the following sections. Figures 3 and 4 provide an overview of the criteria development process for soil remediation criteria and groundwater criteria, respectively. A tabular summary of the components utilized in deriving the various soil and groundwater criteria is presented in Tables 5 and 6. Tabular summary sheets showing the numerical values for each component and the basis (rationale) for all the soil and groundwater criteria in Tables A to D can be found in Appendix A.2.

FIGURE 3: OVERVIEW OF THE SOIL CRITERIA SELECTION PROCESS.

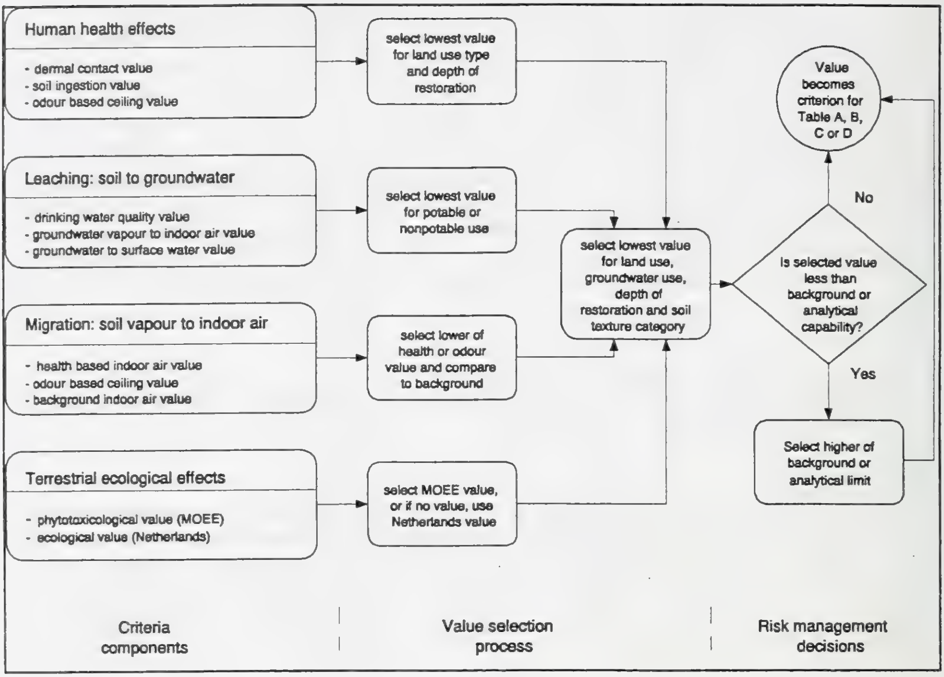
Human health effects
- dermal contact value
- soil ingestion value
- odour based ceiling value
Leaching: soil to groundwater
- drinking water quality value
- groundwater vapour to indoor air value
- groundwater to surface water value
Migration: soil vapour to indoor air
- health based indoor air value
- odour based ceiling value
- background indoor air value
Terrestrial ecological effects
- phytotoxicological value (MOEE)
- ecological value (Netherlands)
select lowest value for land use type and depth of restoration
select lowest value for potable or nonpotable use
select lower of health or odour value and compare to background
select MOEE value, or if no value, use Netherlands value
select lowest value for land use, groundwater use, depth of restoration and soil texture category
Is selected value less than background or analytical capability?
No
Yes
Value becomes criterion for Table A, B, C or D
Select higher of background or analytical limit
Criteria components
Value selection process
Risk management decisions

FIGURE 4: OVERVIEW OF THE GROUNDWATER CRITERIA SELECTION PROCESS.

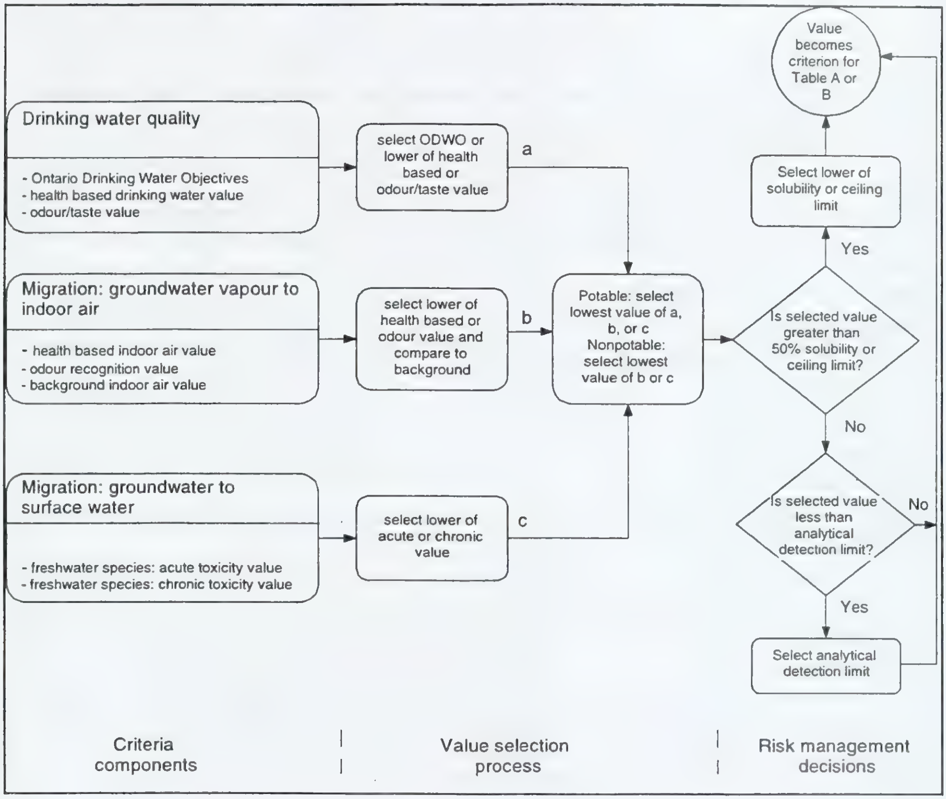
Drinking water quality
- Ontario Drinking Water Objectives
- health based drinking water value
- odour/taste value
select ODWO or lower of health based or odour/taste value
a
Migration: groundwater vapour to indoor air
- health based indoor air value
- odour recognition value
- background indoor air value
select lower of health based or odour value and compare to background
b
Migration: groundwater to surface water
- freshwater species: acute toxicity value
- freshwater species: chronic toxicity value
select lower of acute or chronic value
c
Potable: select lowest value of a, b, or c Nonpotable: select lowest value of b or c
Is selected value greater than 50% solubility or ceiling limit?
Yes
Select lower of solubility or ceiling limit
Value becomes criterion for Table A or B
No
Is selected value less than analytical detection limit?
No
Yes
Select analytical detection limit
Criteria components
Value selection process
Risk management decisions

TABLE 5: GENERIC SOIL REMEDIATION CRITERIA DEVELOPMENT PROCESS - 1996

COMPONENTS UTILIZED IN DEVELOPMENT OF SOIL QUALITY CRITERIA	LU →	A	R/P						I/C					
	RD →	F	F		S		SS		F		S		SS	
	GW →	P	P	NP	P	NP	P	NP	P	NP	P	NP	P	NP
	TAB →	A	A	B	A	B	C	D	A	B	A	B	C	D
COMPONENT GROUP A (EFFECTS-BASED)														
Leaching to GW - Potable Quality (Human Health)		x	x		x		x		x		x		x	
Leaching to GW - Vapour Migration from GW to Indoor Air (Human Health)		x	x	x	x	x	x	x	x	x	x	x	x	x
Leaching to GW - Discharge to Surface Water (Aquatic Organisms)		x	x	x	x	x	x	x	x	x	x	x	x	x
Off-gassing to Ambient Air (Human Health)		x	x	x	x	x			x	x	x	x		
Vapour Migration from Soil to Indoor Air (Human Health)		x	x	x	x	x			x	x	x	x		
Ecological Effects (Bioaccumulation/Grazing Animals)		x												
Ecological Effects - Direct Contact (Plants/Microbes)		x	x	x	x	x			x	x	x	x		
Dermal Contact/Ingestion (Human Health) High Exposure/Accessible Soils (S1)		x	x	x	x	x								
Dermal Contact/Ingestion (Human Health) Moderate Exposure/Accessible Soils (S2)							x	x	x	x	x	x		
Dermal Contact/Ingestion (Human Health) Limited Exposure/Restricted Access (S3)													x	x
COMPONENT GROUP B (EFFECTS-ORIENTED/UNCERTAINTY & POLLUTION PREVENTION BASED)														
S1 Soil Ceiling - Odour Based - High Volatiles		x	x	x	x	x								
S1 Soil Ceiling - Odour Based - Moderate Volatiles		x	x	x	x	x								
S1 Soil Ceiling - Odour Based - Low Volatiles		x	x	x	x	x								
S2 Soil Ceiling - Odour Based - High Volatiles							x	x	x	x	x	x		
S2 Soil Ceiling - Odour Based - Moderate Volatiles							x	x	x	x	x	x		
S2 Soil Ceiling - Odour Based - Low Volatiles							x	x	x	x	x	x		
S3 Soil Ceiling - Odour Based - High Volatiles													x	x
S3 Soil Ceiling - Odour Based - Moderate Volatiles													x	x
S3 Soil Ceiling - Odour Based - Low Volatiles													x	x
COMPONENT GROUP C (RISK MANAGEMENT LEVEL 1 BASED)														
Rural Background Soil Quality		x												
Urban Background Soil Quality			x	x	x	x	x	x	x	x	x	x	x	x
Analytical Capability (MDL/PQL)		x	x	x	x	x	x	x	x	x	x	x	x	x

The soil quality criterion is developed by taking the lowest value of all marked (x) Group A and B components; if this value is greater than both marked Group C components, it becomes the criterion; if it is less than any marked Group C component, then the greater of the marked Group C components becomes the criterion.

LU=Land Use
A=Agricultural
R/P=Residential/Parkland
I/C=Industrial/Commercial

RD=Remediation Depth
F=Full Depth
S=Surface
SS=Sub-Surface

GW=Groundwater Category
P=Potable (drinking)
NP=Non-potable

TAB=Table A-D

TABLE 6: GENERIC GROUNDWATER REMEDIATION CRITERIA DEVELOPMENT PROCESS - 1996

COMPONENTS UTILIZED IN DEVELOPMENT OF GROUNDWATER QUALITY CRITERIA	Potable Table A	Non Potable Table B
COMPONENT GROUP A (EFFECTS-BASED)		
Drinking Water Quality (Human Health)	x	
Vapour Migration from GW to Indoor Air (Human Health)	x	x
Groundwater Discharge to Surface Water (Aquatic Organisms)	x	x
COMPONENT GROUP B (EFFECTS-ORIENTED/UNCERTAINTY & POLLUTION PREVENTION BASED)		
Ceiling Concentration in Water (Odour/Taste)	x	x
Vapour Migration from GW to Indoor Air (50% Odour Recognition)	x	x
COMPONENT GROUP C (RISK MANAGEMENT LEVEL-1 BASED)		
Analytical Capability (MDL/PQL)	x	x
Vapour Migration from GW to Indoor Air (Indoor Air Background)	x	x
Ceiling Concentration in Water (50% of Solubility)	x	x

The groundwater remediation criterion is developed by taking the lowest value of all marked (x) Group A and B components; if this value is greater than the marked Group C component, it becomes the criterion; if it is less than the marked Group C component, then the marked Group C component becomes the criterion.

3.2.6.1 Agricultural Land Use (Soil-All Depths) - Potable Groundwater Situation

These criteria apply to the restoration of both surface and sub-surface soil, and groundwater is always assumed to be potable for this land use category. Direct contact soil concentrations derived for the S-1 soil category are incorporated here. A summary of components used in the soil criteria development process can be found in appendices A.2.1 and A.2.5 for coarse textured and medium/fine textured soils, respectively. The following steps are involved in this decision process for both coarse and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-1**, leaching-based concentrations (**S-/GW-1**, **S-/GW-2**, or **S-/GW-3**), or the soil-to-indoor air concentration **S/IA** (for volatile organics only) is selected for a given chemical.

2) The appropriate S-1 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value determined in step 1 and 2 is selected and carried to the next step in the process.

4) The current agricultural/residential/parkland MOEE SCUG (coarse and medium/fine textured soil) for the given chemical is identified, if it is available.

5) For chemicals for which no agricultural MOEE SCUG exists, the Netherlands "C Level" ecotoxicity criterion for the given chemical is identified, if it is available.

6) The lower value from step 3 and 4, or 3 and 5 if no MOEE SCUG exists, is chosen and carried through to the next step of the process.

7) The value determined in step 6 is checked against model results (AERIS or MOEE Air Toxics model) vapour off-gassing potential to cause exceedance of MOEE Ambient Air Quality Criteria (AAQC). If necessary, the soil value is reduced to meet the AAQC.

8) The appropriate Ontario MDL/Mass. PQL is identified.

9) The appropriate Ontario soil background concentration is identified; in this case the rural background value is utilized.

10) The highest value determined in steps 7, 8 and 9 is selected.

11) The final value derived in step 10 is adopted as the soil remediation criterion for the agricultural land use category and entered into the appropriate column in Table A.

12) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for agricultural/residential/parkland land uses is adopted. For boron (available), the MOEE Phytotoxicology criterion for agricultural, residential and parkland land uses, is adopted.

13) For the following parameters, substitute human health risk-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criteria for agricultural land use
Lead and PAH - MOEE SDB criteria for agricultural land use
PCBs - CCME criteria for agricultural land use
Total Petroleum Hydrocarbons (gas/diesel) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level I criteria
Total Petroleum Hydrocarbons (heavy oils) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level II criteria

3.2.6.2 Residential/Parkland Land Use (Surface Soil) - Potable Groundwater Situation

The process to derive surface soil remediation criteria in the residential/parkland land use category with protection of potable groundwater is very similar to the process used in the agricultural land use category. However, a different set of soil background concentrations (based on urban parkland) were utilized here. As in the agricultural category, direct soil contact concentrations derived for the S-1 soil category are incorporated. A summary of components used in the criteria development process can be found in appendices A.2.1 and A.2.5 for coarse textured and medium/fine textured soils, respectively. The steps are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-1**, leaching-based concentrations (**S-/GW-1**, **S-/GW-2**, or **S-/GW-3**) or the soil-to-indoor air concentration **S/IA** (for volatile organics only) is selected for a given chemical.

2) The appropriate S-1 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value determined in step 1 and 2 is selected and carried to the next step in the process.

4) The current agricultural/residential/parkland MOEE SCUG (coarse and medium/fine textured soil) for the given chemical is identified, if it is available.

5) For chemicals for which no MOEE SCUG exists, the Netherlands "C Level" ecotoxicity criterion for the given chemical is identified, if it is available.

6) The lower value from step 3 and 4, or 3 and 5 if no MOEE SCUG exists, is chosen and carried through to the next step of the process.

7) The value determined in step 6 is checked against model results (AERIS or MOEE Air Toxics model) for vapour off-gassing potential to cause exceedance of MOEE Ambient Air Quality Criteria (AAQC). If necessary, the value is reduced to meet AAQC.

8) The appropriate Ontario MDL/Mass. PQL is identified.

9) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

10) The highest value determined in steps 7, 8 and 9 is selected.

11) The final value derived in step 10 is adopted as the soil remediation criterion for the residential/parkland land use category and is entered into the appropriate column in Table A.

12) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for agricultural/residential/parkland land uses are adopted. For boron (available) the MOEE Phytotoxicology criterion for agricultural, residential and parkland land uses, is adopted.

13) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use
Lead and PAHs - MOEE SDB criterion for residential/parkland land use
PCBs - CCME criterion for residential/parkland land use
Total Petroleum Hydrocarbons (gas/diesel) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level I criteria
Total Petroleum Hydrocarbons (heavy oils) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level II criteria

3.2.6.3 Industrial/Commercial (Surface Soil) - Potable Groundwater Situation

The following decisions were made to derive surface soil remediation criteria for the industrial/commercial category, where the groundwater is potable. For this category, the MCP S-2 direct contact concentrations apply. A summary of components used in the soil criteria development process can be found in appendices A.2.1 and A.2.5 for coarse textured and medium/fine textured soils, respectively. The steps are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-2**, leaching-based concentrations (**S-/GW-1**, **S-/GW-2**, or **S-2/GW-3**) or the soil-to-indoor air concentration **S/IA** (for volatile organics only) is selected for a given chemical.

2) The appropriate S-2 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value determined in step 1 and 2 is selected and carried to the next step in the process.

4) The current industrial/commercial MOEE SCUG (coarse and medium/fine textured soil) for the given chemical is identified, if it is available.

5) For chemicals for which no ind./comm. MOEE SCUG exists, the Netherlands "C Level" ecotoxicity criterion for the given chemical is identified, if available.

6) The lower value from step 3 and 4, or 3 and 5 if no MOEE SCUG exists, is chosen and carried through to the next step of the process.

7) The value determined in step 6 is checked against model results (AERIS or MOEE Air Toxics model) for vapour off-gassing potential to cause exceedance of MOEE Ambient Air Quality Criteria (AAQC). If necessary, the soil value is reduced to meet AAQC.

8) The appropriate Ontario MDL/Mass. PQL is identified.

9) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

10) The highest value determined in steps 7, 8 and 9 is selected.

11) The final value derived in step 10 is adopted as the soil remediation criterion for the industrial/commercial land use category and entered into the appropriate column in Table A.

12) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for industrial/commercial land uses are adopted. For boron (available), the MOEE Phytotoxicology criterion for industrial and commercial land uses, is adopted.

13) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use
Lead and PAHs - MOEE SDB criteria for industrial/commercial land use
PCBs - CCME criteria for industrial/commercial land use
Total Petroleum Hydrocarbons (both) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level II criteria.

3.2.6.4 Residential/Parkland Land Use (Surface Soil) - Non-Potable Groundwater Situation

This process is similar to the one used to derive soil remediation criteria for surface soil in the residential/parkland land use category (potable groundwater) except that the GW-1 groundwater category risk-based concentrations are not incorporated into the process; i.e. only S-/GW-2, and S-/GW-3 leaching-based concentrations were considered. A summary of components used in the soil criteria development process can be found in appendices A.2.2 and A.2.6 for coarse textured and medium/fine textured soils, respectively. The steps are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-1**, leaching-based concentrations (**S-/GW-2**, or **S-/GW-3**) or the soil-to-indoor air concentration **S/IA** (for volatile organics only) is selected for a given chemical.

2) The appropriate S-1 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value determined in step 1 and 2 is selected and carried through to the next step of the process.

4) The current agriculture/residential/parkland MOEE SCUG (coarse and medium fine textured soil) for the given chemical is identified, if it is available.

5) For chemicals for which no MOEE SCUG exists, the Netherlands "C Level ecotoxicity criterion for the given chemical is identified, if it is available.

6) The lower value from steps 3 and 4, or steps 3 and 5 if no MOEE SCUG exists, is chosen and carried through to the next step in the process.

7) The value determined in step 6 is checked against model results (AERIS or MOEE Air Toxics model) for vapour off-gassing potential to cause exceedance of MOEE Ambient Air Quality Criteria (AAQC). If necessary, the soil value is reduced to meet AAQC.

8) The appropriate Ontario MDL/Mass. PQL is identified.

9) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

10) The highest value determined in steps 7, 8 and 9 is selected.

11) The final value derived in step 10 is adopted as the soil remediation criterion for the residential/parkland land use category and entered into the appropriate column in Table B.

12) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for residential/parkland land uses are adopted. For boron (available), the MOEE Phytotoxicology criterion for agricultural, residential and parkland land uses is adopted.

13) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use
Lead and PAHs - MOEE SDB criteria for residential/parkland land use
PCBs - CCME criteria for residential/parkland land use
Total Petroleum Hydrocarbons (both) - MOEE Interim Guideline for Petroleum Contaminated Sites - Level II criteria.

3.2.6.5 Industrial/Commercial Land Use (Surface Soil) - Non-Potable Groundwater Situation

This process is similar to the one used to derive soil remediation criteria for surface soil in the industrial/commercial land use category (potable groundwater) except that the GW-1 groundwater category risk-based concentrations are not incorporated into the process; i.e. only S-/GW-2, and S-/GW-3 leaching-based concentrations are considered. A summary of components used in the soil criteria development process can be found in appendices A.2.2 and A.2.6 for coarse textured and medium/fine textured soils, respectively. The steps are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-2**, leaching-based concentrations (**S-/GW2**, or **S-/GW3**) or the soil-to-indoor air

concentration **S/IA** (for volatile organics only) is selected for a given chemical.

2) The appropriate S-2 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value determined in step 1 and 2 is selected and carried through the next step of the process.

4) The current industrial/commercial MOEE SCUG (coarse and medium/fine textured soil) for the given chemical is identified, if it is available.

5) For chemicals for which no commercial/industrial MOEE SCUG exists, the Netherlands "C Level" ecotoxicity criterion for the given chemical is identified, if it is available.

6) The lower value from step 3 and 4, or 3 and 5 if no MOEE SCUG exists, is chosen and carried through to the next step in the process.

7) The value determined in step 6 is checked against model results (AERIS or MOEE Air Toxics model) for vapour off-gassing potential to cause exceedance of MOEE Ambient Air Quality Criteria (AAQC). If necessary, the soil value is reduced to meet AAQC.

8) The appropriate Ontario MDL/Mass. PQL is identified.

9) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

10) The highest value determined in steps 7, 8 and 9 is selected.

11) The final value derived in step 10 is adopted as the soil remediation criterion for the industrial/commercial land use category and entered into the appropriate column in Table B.

12) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for industrial/commercial land use are adopted. The MOEE Phytotoxicology industrial/commercial criterion for boron (available) is adopted.

13) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use
Lead and PAHs - MOEE SDB criterion for industrial/commercial land use
PCBs - CCME criterion for industrial/commercial land use
Total Petroleum Hydrocarbons (gas/diesel) - MOEE Interim Guidelines for Petroleum Contaminated Sites - Level II criteria
Total Petroleum Hydrocarbons (heavy oils) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level III criteria

3.2.6.6 Residential/Parkland Landuse (Sub-Surface Soil) - Potable Groundwater Situation

In this process, soil remediation criteria are derived for sub-surface soil in the residential/parkland land use category. Protection of potable groundwater is addressed as it was for development of surface soil criteria. However, protection of terrestrial ecological receptors is not considered for soils at depth nor are the results checked for off-gassing to ambient air or for soil vapour migration to indoor air. Also, the exposure scenario for soil at depth is different than that for surface soils.

For the inorganic parameters, arsenic and boron, for which human health-based criteria are not available, less stringent criteria (MOEE SCUGs industrial/commercial) are applied to the sub-surface soils rather than the more stringent criteria (MOEE SCUGs agricultural/residential/parkland) which were adopted for surface soil in this residential/parkland category. It should be noted that neither of the inorganic parameters, Electrical Conductivity and Sodium Absorption Ratio, are applicable at depth because terrestrial ecological receptors are unlikely to be present at depths greater than 1.5 m.

At depth, the potential for direct exposure to humans is reduced compared to potential exposure at the surface. Therefore, risk-based concentrations derived for the S-2 soil category were applied here. For this reason, less stringent, substitute health-based criteria are utilized here for lead, and PCBs but not for dioxin/furans and total petroleum hydrocarbons. A summary of components used in the soil criteria development process can be found in appendices A.2.3 and A.2.7 for coarse textured and medium/fine textured soils, respectively. The steps are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-2** and leaching-based concentrations (**S-/GW1**, **S-/GW2**, or **S-/GW3**) is selected for a given chemical.

2) The appropriate S-2 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value from step 1 and 2 is selected and carried on to the next step in the process.

4) The appropriate Ontario MDL/Mass. PQL is identified.

5) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

6) The highest value determined in steps 3, 4 and 5 is selected.

7) The final value derived in step 6 is adopted as the soil remediation criterion for the residential/parkland land use category and is entered into the appropriate column in Table C.

8) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for industrial/commercial land use were adopted. The industrial/commercial MOEE Phytotoxicology criterion for boron (available) is adopted.

9) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use.
Lead and PAHs - MOEE SDB criterion for industrial/commercial land use
PCBs - CCME criterion for industrial/commercial land use
Total Petroleum Hydrocarbons (gas/diesel) - MOEE Interim Guidelines for Petroleum Contaminated Sites - Level I criteria
Total Petroleum Hydrocarbons (heavy oils) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level II criteria

3.2.6.7 Industrial/Commercial Land Use (Sub-Surface Soil) - Potable Groundwater Situation

The process to derive soil remediation criteria for sub-surface soil with potable groundwater protection in the industrial/commercial land use category is described here. Potable groundwater protection and protection from the impact of contaminant leaching from soil to groundwater and then to surface water receptors are considered in this scenario. Protection of terrestrial ecological receptors is not considered (i.e. exposure pathways to terrestrial ecological receptors at this depth are unlikely), nor are the results checked for off-gassing to ambient air or for soil vapour migration to indoor air.

Unlike the residential/parkland (sub-surface) category, MOEE SCUGs (industrial/commercial) for arsenic and boron are not adopted here. As was the case for the residential/parkland land use category, the inorganic parameters, Electrical Conductivity and Sodium Absorption Ratio are not applicable at depth. At present, criteria are not available for sub-surface soils in the industrial/commercial category for total dioxin/furans, Pb or PCBs.

Again, as for the residential/parkland land use category, the potential for direct exposure to humans is reduced compared to potential exposure at the surface. Therefore, direct contact concentrations derived for the S-3 soil category were applied here. It should be noted that for some chemicals, the S-3 direct contact risk value is lower than the S-2 direct contact risk value (a result of using chronic reference doses vs. subchronic reference doses in the Mass. approach). In these cases, the S-2 direct contact soil concentration (S-2 risk or S-2 ceiling value) is used in place of the S-3 value. A summary of components used in the soil criteria development process can be found in appendices A.2.3 and A.2.7 for coarse textured and medium/fine textured soils, respectively. The steps in this process are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-3** (or **S-2** where S-2 > S-3) and leaching-based concentrations (**S-/GW-1**, **S-/GW-2**, or **S-/GW-3**) is selected for a given chemical.

2) The appropriate S-3 ceiling concentration (S-2 ceiling concentration where S-2 > S-3) is identified (ceiling concentrations can vary by chemical).

3) The lower value from step 1 and 2 is selected and carried on to the next step in the process.

4) The appropriate Ontario MDL/Mass. PQL is identified.

5) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

6) The highest value determined in steps 3, 4 and 5 is selected.

7) The final value derived in step 6 is adopted as the soil remediation criterion for the industrial/commercial land use category and is entered into the appropriate column in Table C.

8) For the following chemicals, substitute effects-based criteria are adopted:
PAHs - MOEE SDB criterion for industrial/commercial land use
Total Petroleum Hydrocarbons (both) - MOEE Interim Guidelines for Petroleum Contaminated Site - Level II criteria.

9) For any remaining chemicals, a criterion value is not assigned at this time.

3.2.6.8 Residential/Parkland Landuse (Sub-Surface Soil) - Non-Potable Groundwater Situation

At depth, the potential for direct exposure to humans is reduced compared to potential exposure at the surface. Therefore, risk-based concentrations derived for the S-2 soil category were applied here for development of sub-surface criteria for the residential/parkland land use category (non-potable groundwater). Protection of groundwater for drinking purposes is not a concern here, although movement of contaminants from soil to groundwater to indoor air, and from soil to groundwater to surface water ecological receptors are considered. Therefore, only the leaching based concentrations derived for S-/GW-2, and S-/GW-3 were used. Protection of terrestrial ecological receptors does not apply at depth (>1.5 m), nor are the results checked for off-gassing to ambient air or for soil vapour migration to indoor air. For the same reason, less stringent, substitute health-based criteria were utilized here (for lead, PCBs and total petroleum hydrocarbons).

In the absence of human health risk-based concentrations, ecological criteria were incorporated for arsenic and boron. For these two inorganic parameters, less stringent criteria (MOEE SCUGs comm./ind.) are applied to the sub-surface soils rather than the more stringent criteria (MOEE SCUGs agr./res./parkland) adopted for surface soil restoration in this residential/parkland category. The inorganic parameters, Electrical Conductivity and Sodium Absorption Ratio, are not applicable at depth. A summary of components used in the soil criteria development process can be found in appendices A.2.4 and A.2.8 for coarse textured and medium/fine textured soils, respectively. The steps in the process are as follows for both coarse textured and medium/fine textured soil criteria:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-2** and leaching-based concentrations (**S-/GW-2**, or **S-/GW-3**) is selected for a given chemical.

2) The appropriate S-2 ceiling concentration is identified (ceiling concentrations can vary by chemical).

3) The lower value from step 1 and 2 is selected and carried to the next step in the process.

4) The appropriate Ontario MDL/Mass. PQL is identified.

5) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

6) The highest value determined in steps 3, 4 and 5 is selected.

7) The final value derived in step 6 is adopted as the soil remediation criterion for the residential/parkland land use category and is entered into the appropriate column in Table D.

8) For arsenic, the existing MOEE SCUG (coarse and medium/fine textured soil) criteria for industrial/commercial land uses are adopted. The industrial/commercial MOEE Phytotoxicology soil criterion for boron (available) is adopted.

9) For the following chemicals, substitute effects-based criteria are adopted:
Dioxin/furans (TEQ) - MOEE criterion for residential/parkland land use.
Lead, PAHs - MOEE SDB criterion for industrial/commercial land use
Chloroethylene values are modified
PCBs - CCME criterion for industrial/commercial land use
Total Petroleum Hydrocarbons (both) - MOEE Interim Guidelines for Petroleum Contaminated Sites - Level III.

3.2.6.9 Industrial/Commercial Land Use (Sub-Surface Soil) - Non-Potable Groundwater Situation

The process to derive soil remediation criteria for sub-surface soil with non-potable groundwater protection in the industrial/commercial land use category is described here. Protection of ecological receptors is not considered, nor are the results checked for off-gassing to ambient air or for soil vapour migration to indoor air. Unlike the residential/parkland (sub-surface) category, ecological criteria are not utilized for Arsenic and Boron. As was the case for the residential/parkland land use (sub-surface) category, the inorganic parameters, Electrical Conductivity and Sodium Absorption Ratio are not applicable at depth. At present, criteria for sub-surface soils in the industrial/commercial category are not available for total dioxin/furans, Pb or PCBs. The least stringent substitute total petroleum hydrocarbons were utilized here.

Again, as for the residential/parkland land use (sub-surface) category, the potential for direct exposure to humans is reduced compared to potential exposure at the surface. Groundwater is not being protected for drinking water purposes. Therefore, S-3 direct soil contact concentrations were incorporated here. Again, for some chemicals, the S-3 direct contact risk value is lower than the S-2 direct contact risk value (a result of using chronic reference doses vs. subchronic reference doses in the Mass. approach). In these cases, the S-2 direct contact soil concentration (S-2 risk or S-2 ceiling value) is used in place of the S-3 value. A summary of components used in the soil criteria development process can be found in appendices A.2.4 and A.2.8 for coarse textured and medium/fine textured soils, respectively. The steps in this process are as follows for both coarse textured and medium/fine textured soils:

1) For all chemicals, the lowest value derived for either the direct soil contact concentration **S-3** (or **S-2** where S-2 > S-3) and leaching-based concentrations (**S-/GW-2**, or **S-/GW-3**) is selected for each chemical.

2) The appropriate S-3 ceiling concentration (S-2 ceiling concentration where S-2 > S-3) is identified (ceiling concentrations can vary by chemical).

3) The lower value from step 1 and 2 is selected and carried on to the next step in the process.

4) The appropriate Ontario MDL/Mass. PQL is identified.

5) The appropriate Ontario soil background concentration is identified; in this case the urban background value is utilized.

6) The highest value determined in steps 3, 4 and 5 is selected.

7) The final value derived in step 6 is adopted as the soil remediation criterion for the industrial/commercial land use category and is entered in the appropriate column in Table D.

8) For the following chemicals, substitute effects-based criteria are adopted:
PAHs - MOEE SDB criterion for industrial/commercial land use
Chloroethylene values were modified
Total Petroleum Hydrocarbons (both) - MOEE Interim Guidelines for Petroleum Contaminated Sites - Level III criteria for coarse textured soils and 2 x Level III criteria for medium/fine textured soils.

9) For any remaining chemicals, a criterion value is not assigned at this time.

3.2.6.10 Potable Groundwater - All Land Uses

For each chemical, the groundwater concentrations derived for the three groundwater categories, GW-1, GW-2 and GW-3 (using the modified MCP standards approach) were incorporated into the development process to derive remediation criteria for potable groundwater. The appropriate vapour transport model for coarse textured soil vs. medium/fine textured soil situation was used. A summary of components used in the potable groundwater criteria development process can be found in appendices A.2.1 and A.2.5 for coarse textured and medium/fine textured soil situations, respectively. The steps in the potable groundwater criteria development process are:

1) The lowest of the three risk-based values for each chemical (**GW-1**, **GW-2**, **GW-3**) is selected and carried to the next step in the process. It should be noted that the GW-1 values consist of Ontario drinking water objectives (when available), Massachusetts standards/guidelines and risk-based values developed by Massachusetts.

2) A value of 50% of the chemical solubility is identified.

3) The lower value from step 1 and 2 is selected and carried through the process.

4) The value determined in step 3 is compared with the ceiling concentration (50,000 ug/L) and the lower of the two values is selected and carried through the process.

5) The appropriate Ontario MDL/Mass. PQL is identified.

6) The higher of the two values determined in step 4 and 5 is selected and adopted as the potable groundwater remediation criterion for the given contaminant and entered into the appropriate column of Table A.

3.2.6.11 Non-Potable Groundwater - All Land Uses

For non-potable groundwater, only the concentrations derived for the groundwater categories GW-2 and GW-3, using the modified MCP standards approach, were incorporated into the development process. Again the appropriate vapour transport model for coarse textured soil vs. medium/fine textured soil situation was used. A summary of components used in the groundwater criteria development process can be found in appendices A.2.2 and A.2.6 for coarse textured and medium/fine textured soil situations, respectively. The steps in the non-potable groundwater criteria development process are as follows:

1) The lower of the two risk-based values for each chemical (**GW-2** and **GW-3**) is selected and carried to the next step in the process.

2) A value of 50% of the chemical solubility is identified.

3) The lower value from step 1 and 2 is selected and carried through the process.

4) The value determined in step 3 is compared with the ceiling concentration (50,000 ug/L) and the lower of the two values is selected and carried through the process.

5) The appropriate Ontario MDL/Mass. PQL is identified.

6) The higher of the two values determined in step 4 and 5 is selected and adopted as the non-potable groundwater remediation criterion for the given contaminant and entered into the appropriate column of Table B.

3.2.7 Generic Criteria Tables

The effects-based criteria for soils and groundwater are presented in Tables A to D (Appendix A.1.1 to A.1.4). A restriction has been imposed on the use of soil criteria for inorganic contaminants in these tables. Soil criteria for inorganics apply only where soil pH is 5.0 to 9.0 for surface (≤1.5 m) soils, and 5.0 to 11.0 for sub-surface (>1.5 m) soils. For sites where soil pH falls outside the range of the generic criteria, the proponent will be required to undertake a limited risk assessment or to utilize the appropriate land use based background soil criteria (Table F). This restriction, along with other situations where the assumptions made in the development of the generic criteria would not apply, are explained in more detail in the 'Potentially Sensitive Sites' part (Section 6.1) of the main guideline.

A set of sediment quality guidelines have been included in Table E (Appendix A.1.5). In some situations, background concentrations of chemical parameters in agricultural and other land use situations are required as assessment criteria or as surrogates for missing effects-based soil criteria. These criteria are listed in Table F (Appendix A.1.6).

3.2.8 Application of the Generic Soil and Groundwater Remediation Criteria

Although generic criteria are now available for 117 different inorganic and organic chemical parameters, the remediation process is concerned only with those contaminants that have been identified in a phase 1 or 2 site assessment. Accordingly, mandatory sampling and analysis of a core group of contaminants is not required, nor can it be assumed that analysis for a suspected contaminant can be ignored if it is not listed in Tables A-D.

The proponent must decide whether to select a Full Depth or a Stratified Depth Remediation. In addition to this decision, the proponent must also decide on the groundwater use status on and/or in the vicinity of the site - potable or non-potable and whether the soil meets the definition of coarse texture or medium/fine texture.

The final decision to be made is the proposed remediated land use category - agricultural, residential/parkland, or industrial/commercial. Figure 5 summarizes the criteria tables which apply to full depth and stratified depth remediations for both soil and groundwater criteria. Selection of the individual soil or groundwater criterion from the appropriate table then proceeds as follows:

Full Depth Remediation:

Potable Groundwater Use	- Soil and Groundwater Criteria from Table A
Non-Potable Groundwater Use	- Soil and Groundwater Criteria from Table B

Stratified Depth Remediation:

Potable Groundwater Use	- Surface Soil and Groundwater Criteria - Table A - Sub-surface Soil Criteria from Table C
Non-Potable Groundwater Use	- Surface Soil and Groundwater Criteria - Table B - Sub-surface Soil Criteria from Table D

Within each table, individual clean-up criteria for both coarse textured and medium/fine textured soils (surface and sub-surface) are shown for each land use category. No distinction is made for land use in the case of groundwater, as this is not a factor in groundwater protection.

FIGURE. 5 Selection of Generic Soil and Ground Water Criteria

Full Depth Restoration

Full depth Condition	Soil and Ground Water Criteria by Land Use and Existing or Future Ground Water Use						
	Potable Ground Water Use				Non-Potable Ground Water Use		
	Agr Soil	Res\Park Soil	Ind\Com Soil	Potable Ground Water	Res\Park Soil	Ind\Com Soil	Non-potable Ground Water
from surface to depth of contamination	Table A				Table B		

Stratified Depth Restoration

Stratified Condition	Soil and Ground Water Criteria by Land Use and Existing or Future Ground Water Use					
	Potable Ground Water Use			Non-Potable Ground Water Use		
	Res\Park Soil	Ind\Com Soil	Potable Ground Water	Res\Park Soil	Ind\Com Soil	Non-potable Ground Water
from surface to 1.5 m below surface	Table A			Table B		
below 1.5 m to depth of contamination	Table C			Table D		

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APPENDIX A: Criteria Tables A to F.

Appendix A.1: Ontario Soil, Groundwater and Sediment Quality Criteria Tables.

This section summarizes all effects and background-based criteria developed for the restoration of contaminated sites. A brief description of the six tables A to F follows:

Table A:	Surface Soil and Groundwater Remediation Criteria for Three Land Uses (Agricultural, Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.
Table B:	Surface Soil and Groundwater Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.
Table C:	Sub-Surface Soil Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.
Table D:	Sub-Surface Soil Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.
Table E:	Sediment Quality Criteria
Table F:	Ontario Background Soil Concentrations

It should be noted that in the case of Tables A to D, a pH condition for inorganic parameters is in effect. Also, for some chemical parameters, the sub-surface soil criterion (Tables C and D) is identical to the corresponding surface soil value (Tables A and B). As the use of the Table C and D criteria has administrative/legal ramifications (registration on land title), all criteria in Tables C and D that are identical to those in Tables A and B are marked with an asterisk. Finally, it should be noted that the use of the effects-based soil and groundwater criteria in Tables A to D, or the background-based soil values in Table F, beyond the scope and intent of the Ministry's contaminated site guideline should not be undertaken without prior consultation with the Standards Development Branch.

Appendix A.1.1: Table A - Surface Soil/Full Depth and Groundwater Remediation Criteria for Three Land Uses (Agricultural, Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.

TABLE A: Surface Soil and Groundwater Remediation Criteria for Three Land Uses (Agricultural, Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE A:	Soil Remediation Criteria (ug/g)			Potable Groundwater Criteria (ug/L)
Chemical Compound	**Agricultural Land Use**	**Residential/ Parkland Land Use**	**Industrial/ Commercial Land Use**	**All Land Use Categories**
ACENAPHTHENE	15	15	15	20
ACENAPHTHYLENE	100	100	130	310
ACETONE	3.5	3.5	3.5	3000
ALDRIN	0.05	0.05	0.05	0.01
ANTHRACENE	28	28	28	12
ANTIMONY	13	13	(44) 40	6.0
ARSENIC	(25) 20	(25) 20	(50) 40	25
BARIUM	(1000) 750	(1000) 750	(2000) 1500	1000
BENZENE	0.24	0.24	0.24	5.0
BENZO(a)ANTHRACENE	6.6	6.6	6.6	0.2
BENZO(a)PYRENE	1.2	1.2	1.9	0.01
BENZO(b)FLUORANTHENE	12	12	18	0.2
BENZO(g,h,i)PERYLENE	40	40	40	0.2
BENZO(k)FLUORANTHENE	12	12	18	0.2
BERYLLIUM	1.2	1.2	1.2	4.0
BIPHENYL, 1,1-	0.89	0.89	0.89	350
BIS(2-CHLOROETHYL)ETHER	0.66	0.66	0.66	4.4
BIS(2-CHLOROISOPROPYL)ETHER	0.66	0.66	0.66	2.2
BIS(2-ETHYLHEXYL)PHTHALATE	100	100	100	6.0
BORON (AVAILABLE)	1.5^{+}	1.5^{+}	2.0^{+}	5000
BROMODICHLOROMETHANE	0.12	0.12	0.12	5.0
BROMOFORM	0.11	0.11	0.11	5.0
BROMOMETHANE	(0.38) 0.061	(0.38) 0.061	(0.38) 0.061	(10) 3.7
CADMIUM	(4.0) 3.0	12	12	5.0
CARBON TETRACHLORIDE	(0.64) 0.10	(0.64) 0.10	(0.64) 0.10	5.0
CHLORDANE	0.29	0.29	0.29	0.04
CHLOROANILINE, p-	1.3	1.3	1.3	28
CHLOROBENZENE	2.4	2.4	2.4	30

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE A:	Soil Remediation Criteria (ug/g)			Potable Groundwater Criteria (ug/L)
Chemical Compound	Agricultural Land Use	Residential/ Parkland Land Use	Industrial/ Commercial Land Use	All Land Use Categories
CHLOROFORM	0.13	0.13	0.13	5.0
CHLOROPHENOL, 2-	0.1	0.1	0.1	0.3
CHROMIUM (TOTAL)	(1000) 750	(1000) 750	(1000) 750	50
CHROMIUM (VI)	(10) 8.0	(10) 8.0	(10) 8.0	50
CHRYSENE	12	12	17	0.5
COBALT	(50) 40	(50) 40	(100) 80	100
COPPER	(200) 150	(300) 225	(300) 225	23
CYANIDE (FREE)	100	100	100	52
DIBENZO(a,h)ANTHRACENE	1.2	1.2	1.9	0.2
DIBROMOCHLOROMETHANE	0.09	0.09	0.09	5.0
DICHLOROBENZENE, 1,2- (o-DCB)	0.88	0.88	0.88	3.0
DICHLOROBENZENE, 1,3- (m-DCB)	30	30	30	630
DICHLOROBENZENE, 1,4- (p-DCB)	0.32	0.32	0.32	1.0
DICHLOROBENZIDINE, 3,3'-	1.3	1.3	1.3	83
DDD	2.2	2.2	3.5	6.0
DDE	1.6	1.6	2.4	20
DDT	1.6	1.6	2.0	0.05
DICHLOROETHANE, 1,1-	3.0	3.0	3.0	70
DICHLOROETHANE, 1,2-	(0.05) 0.022	(0.05) 0.022	(0.05) 0.022	5.0
DICHLOROETHYLENE, 1,1-	(0.015) 0.0024	(0.015) 0.0024	(0.015) 0.0024	(4.1) 0.66
DICHLOROETHYLENE, CIS-1,2-	2.3	2.3	2.3	70
DICHLOROETHYLENE, TRANS-1,2-	4.1	4.1	4.1	100
DICHLOROPHENOL, 2,4-	0.3	0.3	0.3	0.3
DICHLOROPROPANE, 1,2-	(0.12) 0.019	(0.12) 0.019	(0.12) 0.019	5.0
DICHLOROPROPENE, 1,3-	(0.04) 0.0066	(0.04) 0.0066	(0.04) 0.0066	1 4
DIELDRIN	0.05	0.05	0.05	0.02
DIETHYL PHTHALATE	0.71	0.71	0.71	30
DIMETHYL PHTHALATE	0.7	0.7	0.7	30
DIMETHYLPHENOL, 2,4-	0.94	0.94	0.94	140
DINITROPHENOL, 2,4-	0.2	0.2	0.2	42
DINITROTOLUENE, 2,4-	0.66	0.66	0.66	0.5

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE A:	Soil Remediation Criteria (ug/g)			Potable Groundwater Criteria (ug/L)
Chemical Compound	Agricultural Land Use	Residential/ Parkland Land Use	Industrial/ Commercial Land Use	All Land Use Categories
DIOXIN/FURAN (ng TEQ/g soil)	0.01	1.0	1.0	0.000015
ENDOSULFAN	0.18	0.18	0.18	0.35
ENDRIN	0.05	0.05	0.05	0.05
ETHYLBENZENE	0.28	0.28	0.28	2.4
ETHYLENE DIBROMIDE	(0.01) 0.0056	(0.01) 0.0056	(0.012) 0.0056	1.0
FLUORANTHENE	40	40	40	130
FLUORENE	340	340	340	280
HEPTACHLOR	(0.12) 0.084	(0.12) 0.084	(0.15) 0.084	0.04
HEPTACHLOR EPOXIDE	0.06	0.06	0.09	3.0
HEXACHLOROBENZENE	0.46	0.46	0.76	(1.0) 0.62
HEXACHLOROBUTADIENE	(2.2) 0.38	(2.2) 0.38	(2.2) 0.38	0.45
HEXACHLOROCYCLOHEXANE, GAMMA	0.41	0.41	0.49	0.8
HEXACHLOROETHANE	(6.3) 3.8	(6.3) 3.8	(8.5) 3.8	2.5
INDENO(1,2,3-cd)PYRENE	12	12	19	0.2
LEAD	200	200	1000	10
MERCURY	10	10	10	0.12
METHOXYCHLOR	4.0	4.0	4.0	0.3
METHYL ETHYL KETONE	0.27	0.27	0.27	350
METHYL ISOBUTYL KETONE	0.48	0.48	0.48	350
METHYL MERCURY	6.8^{++}	6.8^{++}	10^{++}	0.12
METHYL TERT BUTYL ETHER	5.7	5.7	5.7	700
METHYLENE CHLORIDE	1.1	1.1	1.1	50
METHYLNAPHTHALENE, 2-(*1-)	1.2	1.2	1.2	10
MOLYBDENUM	5.0	40	40	7300
NAPHTHALENE	4.6	4.6	4.6	21
NICKEL	(200) 150	(200) 150	(200) 150	100
PENTACHLOROPHENOL	5.0	5.0	5.0	30
PETROLEUM HYDROCARBONS (gas/diesel)	100	100	100	1000
PETROLEUM HYDROCARBONS (heavy oils)	1000	1000	1000	1000
PHENANTHRENE	40	40	40	63
PHENOL	40	40	40	4200

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE A:	Soil Remediation Criteria (ug/g)			Potable Groundwater Criteria (ug/L)
Chemical Compound	Agricultural Land Use	Residential/ Parkland Land Use	Industrial/ Commercial Land Use	All Land Use Categories
POLYCHLORINATED BIPHENYLS	0.5	5.0	25	0.2
PYRENE	250	250	250	40
SELENIUM	2.0	10	10	10
SILVER	(25) 20	(25) 20	(50) 40	1.2
STYRENE	(1.7) 1.2	(1.7) 1.2	(1.7) 1.2	100
TETRACHLOROETHANE, 1,1,1,2-	(0.12) 0.019	(0.12) 0.019	(0.12) 0.019	5.0
TETRACHLOROETHANE, 1,1,2,2-	0.01	0.01	0.01	1.0
TETRACHLOROETHYLENE	0.45	0.45	0.45	5.0
THALLIUM	4.1	4.1	32	2.0
TOLUENE	2.1	2.1	2.1	24
TRICHLOROBENZENE, 1,2,4-	30	30	30	70
TRICHLOROETHANE, 1,1,1-	(34) 26	(34) 26	(34) 26	200
TRICHLOROETHANE, 1,1,2-	0.28	0.28	0.28	5.0
TRICHLOROETHYLENE	(3.9) 1.1	(3.9) 1.1	(3.9) 1.1	50
TRICHLOROPHENOL, 2,4,5-	3.2	3.2	3.2	200
TRICHLOROPHENOL 2,4,6-	0.66	0.66	0.66	2.0
VANADIUM	(250) 200	(250) 200	(250) 200	200
VINYL CHLORIDE	(0.0075) 0.003	(0.0075) 0.003	(0.0075) 0.003	(1.3) 0.5
XYLENES	25	25	25	300
ZINC	(800) 600	(800) 600	(800) 600	1100
ELECTRICAL CONDUCTIVITY (mS/cm)	0.70	0.70	1.4	N/A
CHLORIDE	N/V	N/V	N/V	250000
NITRATE	N/V	N/V	N/V	10000
NITRITE	N/V	N/V	N/V	1000
SODIUM ADSORPTION RATIO (SAR)	5.0	5.0	12	N/A
SODIUM	N/V	N/V	N/V	200000

( ) Criterion value in brackets applies to medium and fine textured soils.

+ Boron soil criterion based on Hot Water Extract. N/A = Not applicable. N/V = No Value.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

Appendix A.1.2: Table B - Surface Soil/Full Depth and Groundwater Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.

TABLE B: Surface Soil and Groundwater Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE B:	Soil Remediation Criteria (ug/g)		Non-Potable Groundwater Criteria (ug/L)
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use	Both Land Use Categories
ACENAPHTHENE	1000	1300	1700
ACENAPHTHYLENE	100	840	2000
ACETONE	3.8	3.8	3300
ALDRIN	0.05	0.05	(1.3) 0.2
ANTHRACENE	28	28	12
ANTIMONY	13	(44) 40	16000
ARSENIC	(25) 20	(50) 40	480
BARIUM	(1000) 750	(2000) 1500	23000
BENZENE	(25) 5.3	(25) 5.3	(12000) 1900
BENZO(a)ANTHRACENE	40	40	5.0
BENZO(a)PYRENE	1.2	1.9	1.9
BENZO(b)FLUORANTHENE	12	19	7.0
BENZO(g,h,i)PERYLENE	40	40	0.2
BENZO(k)FLUORANTHENE	12	19	0.4
BERYLLIUM	1.2	1.2	53
BIPHENYL, 1,1-	4.3	4.3	1700
BIS(2-CHLOROETHYL)ETHER	0.66	0.66	(710) 110
BIS(2-CHLOROISOPROPYL)ETHER	(1.9) 0.82	(2.6) 0.82	(2700) 430
BIS(2-ETHYLHEXYL)PHTHALATE	130	330	30
BORON (AVAILABLE)	1.5^{+}	2.0^{+}	50000
BROMODICHLOROMETHANE	14	25	50000
BROMOFORM	(14) 2.3	(14) 2.3	(5200) 840
BROMOMETHANE	(0.38) 0.061	(0.38) 0.061	(16) 3.7
CADMIUM	12	12	11
CARBON TETRACHLORIDE	(0.64) 0.10	(0.64) 0.10	(100) 17
CHLORDANE	0.29	0.29	0.04
CHLOROANILINE, p-	1.3	1.3	100
CHLOROBENZENE	(30) 8.0	(30) 8.0	500

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE B:	**Soil Remediation Criteria (ug/g)**		**Non-Potable Groundwater Criteria (ug/L)**
Chemical Compound	**Residential/ Parkland Land Use**	**Industrial/ Commercial Land Use**	**Both Land Use Categories**
CHLOROFORM	(4.9) 0.79	(4.9) 0.79	(2700) 430
CHLOROPHENOL, 2-	10	10	44000
CHROMIUM (TOTAL)	(1000) 750	(1000) 750	2000
CHROMIUM (VI)	(10) 8.0	(10) 8.0	110
CHRYSENE	12	19	3.0
COBALT	(50) 40	(100) 80	100
COPPER	(300) 225	(300) 225	23
CYANIDE (FREE)	100	100	52
DIBENZO(a,h)ANTHRACENE	1.2	1.9	0.25
DIBROMOCHLOROMETHANE	10	18	50000
DICHLOROBENZENE, 1,2- (o-DCB)	30	30	7600
DICHLOROBENZENE, 1,3- (m-DCB)	30	30	7600
DICHLOROBENZENE, 1,4- (p-DCB)	30	30	7600
DICHLOROBENZIDINE, 3,3'-	1.3	1.3	1600
DDD	2.2	3.5	6.0
DDE	1.6	2.4	20
DDT	1.6	2.0	0.05
DICHLOROETHANE, 1,1-	(100) 22	(140) 22	(50000) 9000
DICHLOROETHANE, 1,2-	(0.14) 0.022	(0.14) 0.022	(110) 17
DICHLOROETHYLENE, 1,1-	(0.015) 0.0024	(0.015) 0.0024	(4.1) 0.66
DICHLOROETHYLENE, CIS-1,2-	2.3*	2.3*	70*
DICHLOROETHYLENE, TRANS-1,2-	4.1*	4.1*	100*
DICHLOROPHENOL, 2,4-	10	10	3700
DICHLOROPROPANE, 1,2-	(0.12) 0.019	(0.12) 0.019	(58) 9.3
DICHLOROPROPENE, 1,3-	(0.041) 0.0066	(0.041) 0.0066	(24) 3.8
DIELDRIN	0.05	0.05	0.02
DIETHYL PHTHALATE	0.71	0.71	30
DIMETHYL PHTHALATE	0.7	0.7	30
DIMETHYLPHENOL, 2,4-	140	140	21000
DINITROPHENOL, 2,4-	4.1	4.1	1500
DINITROTOLUENE, 2,4-	1.1	1.8	2300

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0			
TABLE B:	Soil Remediation Criteria (ug/g)		Non-Potable Groundwater Criteria (ug/L)
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use	Both Land Use Categories
DIOXIN/FURAN (ng TEQ/g soil)	1.0	1.0	0.000015
ENDOSULFAN	0.29	0.29	0.56
ENDRIN	0.05	0.05	0.05
ETHYLBENZENE	(500) 290	(1000) 290	(50000) 28000
ETHYLENE DIBROMIDE	(0.01) 0.0056	(0.02) 0.0056	(21) 3.3
FLUORANTHENE	40	40	130
FLUORENE	350	350	290
HEPTACHLOR	(0.12) 0.084	(0.15) 0.084	0.04
HEPTACHLOR EPOXIDE	0.06	0.09	(37) 6.0
HEXACHLOROBENZENE	0.46	0.76	(3.9) 0.62
HEXACHLOROBUTADIENE	(2.4) 0.38	(2.4) 0.38	(5.4) 0.87
HEXACHLOROCYCLOHEXANE, GAMMA	0.41	0.49	0.8
HEXACHLOROETHANE	(6.3) 3.8	(13) 3.8	(78) 12
INDENO(1,2,3-cd)PYRENE	12	19	0.27
LEAD	200	1000	32
MERCURY	10	10	0.12
METHOXYCHLOR	4.0	4.0	0.3
METHYL ETHYL KETONE	38	38	50000
METHYL ISOBUTYL KETONE	(69) 58	(69) 58	50000
METHYL MERCURY	6.8^{++}	10^{++}	0.12
METHYL TERT BUTYL ETHER	100	(410) 120	50000
METHYLENE CHLORIDE	120	(200) 140	50000
METHYLNAPHTHALENE, 2-(*1-)	(1000) 280	(1600) 280	13000
MOLYBDENUM	40	40	7300
NAPHTHALENE	40	40	(6200) 5900
NICKEL	(200) 150	(200) 150	1600
PENTACHLOROPHENOL	5.0	5.0	130
PETROLEUM HYDROCARBONS(gas/diesel)	1000	(2000) 1000	N/V
PETROLEUM HYDROCARBONS(heavy oils)	1000	5000	N/V
PHENANTHRENE	40	40	63
PHENOL	40	40	26000

Soil Criteria for Inorganics in this Table apply only where Surface Soil pH is 5.0 to 9.0 and for Full Depth Use, the Subsurface Soil pH is 5.0 to 11.0

TABLE B:	Soil Remediation Criteria (ug/g)		Non-Potable Groundwater Criteria (ug/L)
Chemical Compound	**Residential/ Parkland Land Use**	**Industrial/ Commercial Land Use**	**Both Land Use Categories**
POLYCHLORINATED BIPHENYLS	5.0	25	0.2
PYRENE	250	250	40
SELENIUM	10	10	50
SILVER	(25) 20	(50) 40	1.2
STYRENE	(7.7) 1.2	(7.7) 1.2	(5900) 940
TETRACHLOROETHANE, 1,1,1,2-	(0.12) 0.019	(0.12) 0.019	(38) 6.0
TETRACHLOROETHANE, 1,1,2,2-	(0.23) 0.037	(0.23) 0.037	(140) 22
TETRACHLOROETHYLENE	0.45*	0.45*	5.0*
THALLIUM	4.1	32	400
TOLUENE	(150) 34	(150) 34	(37000) 5900
TRICHLOROBENZENE, 1,2,4-	30	30	500
TRICHLOROETHANE, 1,1,1-	(34)* 26*	(34)* 26*	200*
TRICHLOROETHANE, 1,1,2-	2.3	3.1	(50000) 16000
TRICHLOROETHYLENE	(3.9)* 1.1*	(3.9)* 1.1*	50*
TRICHLOROPHENOL, 2,4,5-	10	10	630
TRICHLOROPHENOL 2,4,6-	10	10	9700
VANADIUM	(250) 200	(250) 200	200
VINYL CHLORIDE	(0.0075) 0.003	(0.0075) 0.003	(1.3) 0.5
XYLENES	(210) 34	(210) 34	(35000) 5600
ZINC	(800) 600	(800) 600	1100
ELECTRICAL CONDUCTIVITY (mS/cm)	0.70	1.4	N/A
CHLORIDE	N/V	N/V	N/V
NITRATE	N/V	N/V	N/V
NITRITE	N/V	N/V	2000
SODIUM ADSORPTION RATIO (SAR)	5.0	12	N/A
SODIUM	N/V	N/V	N/V

( ) Criterion value in brackets applies to medium and fine textured soils.

+ Boron soil criterion based on Hot Water Extract. N/A = Not applicable. N/V = No Value.

* Soil or groundwater criterion adopted from Table A (potable groundwater situation) to account for degradation to vinyl chloride.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

Appendix A.1.3: Table C - Sub-Surface Soil Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.

TABLE C: Sub-Surface Soil Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Potable Groundwater Situation.

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0		
TABLE C:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
ACENAPHTHENE	15*	15*
ACENAPHTHYLENE	130	130*
ACETONE	3.5*	3.5*
ALDRIN	0.05*	0.08
ANTHRACENE	28*	28*
ANTIMONY	44	44
ARSENIC	(50) 40	N/V
BARIUM	2500	4100
BENZENE	0.24*	0.24*
BENZO(a)ANTHRACENE	6.6*	6.6*
BENZO(a)PYRENE	1.9	7.2
BENZO(b)FLUORANTHENE	18	18*
BENZO(g,h,i)PERYLENE	53	53
BENZO(k)FLUORANTHENE	18	18*
BERYLLIUM	1.2*	3.1
BIPHENYL, 1,1-	0.89*	0.89*
BIS(2-CHLOROETHYL)ETHER	0.66*	0.66*
BIS(2-CHLOROISOPROPYL)ETHER	0.66*	0.66*
BIS(2-ETHYLHEXYL)PHTHALATE	100*	100*
BORON (AVAILABLE)	2.0+	N/V
BROMODICHLOROMETHANE	0.12*	0.12*
BROMOFORM	0.11*	0.11*
BROMOMETHANE	(12) 4.5	(12) 4.5
CADMIUM	41	41
CARBON TETRACHLORIDE	1.0	1.0
CHLORDANE	0.29*	0.29*
CHLOROANILINE, p-	1.3*	1.3*
CHLOROBENZENE	2.4*	2.4*
CHLOROFORM	0.13*	0.13*
CHLOROPHENOL, 2-	0.1*	0.1*

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0

TABLE C:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
CHROMIUM (TOTAL)	2500	5000
CHROMIUM (VI)	600	1100
CHRYSENE	17	17*
COBALT	2500	3400
COPPER	2500	2500
CYANIDE (FREE)	100*	390
DIBENZO(a,h)ANTHRACENE	1.9	7.2
DIBROMOCHLOROMETHANE	0.09*	0.09*
DICHLOROBENZENE, 1,2- (o-DCB)	0.88*	0.88*
DICHLOROBENZENE, 1,3- (m-DCB)	190	190
DICHLOROBENZENE, 1,4- (p-DCB)	0.32*	0.32*
DICHLOROBENZIDINE, 3,3'-	1.3*	2.7
DDD	3.5	13
DDE	2.4	8.9
DDT	2.0	2.0*
DICHLOROETHANE, 1,1-	3.0*	3.0*
DICHLOROETHANE, 1,2-	0.05**	0.05**
DICHLOROETHYLENE, 1,1-	(0.42) 0.07	(0.42) 0.07
DICHLOROETHYLENE, CIS-1,2-	2.3*	2.3*
DICHLOROETHYLENE, TRANS-1,2-	4.1*	4.1*
DICHLOROPHENOL, 2,4-	0.3*	0.3*
DICHLOROPROPANE, 1,2-	0.13	0.13
DICHLOROPROPENE, 1,3-	0.04**	0.04**
DIELDRIN	0.05*	0.05*
DIETHYL PHTHALATE	0.71*	0.71*
DIMETHYL PHTHALATE	0.7*	0.7*
DIMETHYLPHENOL, 2,4-	0.94*	0.94*
DINITROPHENOL, 2,4-	0.2*	0.2*
DINITROTOLUENE, 2,4-	0.66*	0.66*
DIOXIN/FURAN (ng TEQ/g soil)	1.0*	N/V
ENDOSULFAN	0.18*	0.18*
ENDRIN	0.05*	0.05*

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0

TABLE C:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
ETHYLBENZENE	0.28*	0.28*
ETHYLENE DIBROMIDE	0.012	0.012**
FLUORANTHENE	840	840
FLUORENE	340*	340*
HEPTACHLOR	0.15	0.15**
HEPTACHLOR EPOXIDE	0.09	0.33
HEXACHLOROBENZENE	0.76	2.8
HEXACHLOROBUTADIENE	2.2**	2.2**
HEXACHLOROCYCLOHEXANE, GAMMA	0.49	0.49*
HEXACHLOROETHANE	8.5	8.5**
INDENO(1,2,3-cd)PYRENE	19	53
LEAD	1000	N/V
MERCURY	57	57
METHOXYCHLOR	4.0*	4.0*
METHYL ETHYL KETONE	0.27*	0.27*
METHYL ISOBUTYL KETONE	0.48*	0.48*
METHYL MERCURY	18++	18++
METHYL TERT BUTYL ETHER	5.7*	5.7*
METHYLENE CHLORIDE	1.1*	1.1*
METHYLNAPHTHALENE, 2-(*1-)	1.2*	1.2*
MOLYBDENUM	550	550
NAPHTHALENE	4.6*	4.6*
NICKEL	710	710
PENTACHLOROPHENOL	12	43
PETROLEUM HYDROCARBONS(gas/diesel)	100*	100*
PETROLEUM HYDROCARBONS(heavy oils)	1000*	1000*
PHENANTHRENE	150	150
PHENOL	64	64
POLYCHLORINATED BIPHENYLS	25	N/V
PYRENE	250*	250*
SELENIUM	2500	2500
SILVER	240	240

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0

TABLE C:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
STYRENE	1.7**	1.7**
TETRACHLOROETHANE, 1,1,1,2-	0.39	0.39
TETRACHLOROETHANE, 1,1,2,2-	0.01*	0.01*
TETRACHLOROETHYLENE	0.45*	0.45*
THALLIUM	32	150
TOLUENE	2.1*	2.1*
TRICHLOROBENZENE, 1,2,4-	110	110
TRICHLOROETHANE, 1,1,1-	34**	34**
TRICHLOROETHANE, 1,1,2-	0.28*	0.28*
TRICHLOROETHYLENE	3.9**	3.9**
TRICHLOROPHENOL, 2,4,5-	3.2*	3.2*
TRICHLOROPHENOL 2,4,6-	0.66*	0.66*
VANADIUM	910	910
VINYL CHLORIDE	(0.25) 0.094	(0.25) 0.094
XYLENES	25*	25*
ZINC	2500	5000
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A	N/A
CHLORIDE	N/V	N/V
NITRATE	N/V	N/V
NITRITE	N/V	N/V
SODIUM ADSORPTION RATIO (SAR)	N/A	N/A
SODIUM	N/V	N/V

( ) Criterion value in brackets applies to medium and fine textured soils.

* Criterion value is the same as the corresponding criterion in Table A.

** Criterion value is the same as the corresponding medium/fine textured soil criterion in Table A.

+ Boron soil criterion based on Hot Water Extract.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are present in the soil, the sum of the two concentrations cannot exceed the soil criterion.

N/A = Not applicable. N/V = No Value.

Appendix A.1.4: Table D - Sub-Surface Soil Remediation Criteria for Two Land Uses(Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.

TABLE D: Sub-Surface Soil Remediation Criteria for Two Land Uses (Residential/Parkland and Industrial/Commercial) in a Non-Potable Groundwater Situation.

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0

TABLE D:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
ACENAPHTHENE	1300	1300*
ACENAPHTHYLENE	840	840*
ACETONE	3.8*	3.8*
ALDRIN	0.05*	0.15
ANTHRACENE	28*	28*
ANTIMONY	44	44**
ARSENIC	(50) 40	N/V
BARIUM	2500	4100
BENZENE	63	(230) 89
BENZO(a)ANTHRACENE	170	170
BENZO(a)PYRENE	1.9	7.2
BENZO(b)FLUORANTHENE	19	72
BENZO(g,h,i)PERYLENE	53	53
BENZO(k)FLUORANTHENE	19	37
BERYLLIUM	1.2*	3.1
BIPHENYL, 1,1-	4.3*	4.3*
BIS(2-CHLOROETHYL)ETHER	0.66*	0.66*
BIS(2-CHLOROISOPROPYL)ETHER	2.6	(9.3) 4.7
BIS(2-ETHYLHEXYL)PHTHALATE	330	500
BORON (AVAILABLE)	2.0+	N/V
BROMODICHLOROMETHANE	25	90
BROMOFORM	(120) 19	(120) 19
BROMOMETHANE	(20) 4.5	(20) 4.5
CADMIUM	41	41
CARBON TETRACHLORIDE	(12) 3.3	(20) 3.3
CHLORDANE	0.29*	0.29*
CHLOROANILINE, p-	1.3*	1.3*
CHLOROBENZENE	40	40
CHLOROFORM	(71) 11	(71) 11
CHLOROPHENOL, 2-	240	800

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0		
TABLE D:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
CHROMIUM (TOTAL))	2500	5000
CHROMIUM (VI)	600	1100
CHRYSENE	19	72
COBALT	2500	3400
COPPER	2500	2500
CYANIDE (FREE)	100•	390
DIBENZO(a,h)ANTHRACENE	1.9	7.2
DIBROMOCHLOROMETHANE	18	67
DICHLOROBENZENE, 1,2- (o-DCB)	500	500
DICHLOROBENZENE, 1,3- (m-DCB)	500	500
DICHLOROBENZENE, 1,4- (p-DCB)	63	230
DICHLOROBENZIDINE, 3,3'-	1.3•	2.7
DDD	3.5	13
DDE	2.4	8.9
DDT	2.0	2.0•
DICHLOROETHANE, 1,1-	(500) 390	(500) 390
DICHLOROETHANE, 1,2-	(1.0) 0.16	(1.0) 0.16
DICHLOROETHYLENE, 1,1-	(0.42) 0.07	(0.42) 0.07
DICHLOROETHYLENE, CIS-1,2-	2.3^{a}•	2.3^{a}•
DICHLOROETHYLENE, TRANS-1,2-	4.1^{a}•	4.1^{a}•
DICHLOROPHENOL, 2,4-	94	94
DICHLOROPROPANE, 1,2-	(1.5) 0.23	(1.5) 0.23
DICHLOROPROPENE, 1,3-	(0.62) 0.10	(0.62) 0.10
DIELDRIN	0.05•	0.05•
DIETHYL PHTHALATE	0.71•	0.71•
DIMETHYL PHTHALATE	0.7•	0.7•
DIMETHYLPHENOL, 2,4-	140•	140•
DINITROPHENOL, 2,4-	4.1•	4.1•
DINITROTOLUENE, 2,4-	1.8	6.6
DIOXIN/FURAN (ng TEQ/g soil)	1.0•	N/V
ENDOSULFAN	0.29•	0.29•
ENDRIN	0.05•	0.05•

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0		
TABLE D:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
ETHYLBENZENE	1000	2500
ETHYLENE DIBROMIDE	0.02	(0.066) 0.038
FLUORANTHENE	840	840
FLUORENE	350*	350*
HEPTACHLOR	0.15	0.15**
HEPTACHLOR EPOXIDE	0.09	0.33
HEXACHLOROBENZENE	0.76	2.8
HEXACHLOROBUTADIENE	(11) 4.3	(27) 4.3
HEXACHLOROCYCLOHEXANE, GAMMA	0.49	0.49*
HEXACHLOROETHANE	13	(47) 42
INDENO(1,2,3-cd)PYRENE	19	70
LEAD	1000	N/V
MERCURY	57	57
METHOXYCHLOR	4.0*	4.0*
METHYL ETHYL KETONE	38*	38*
METHYL ISOBUTYL KETONE	69**	69**
METHYL MERCURY	18++	18++
METHYL TERT BUTYL ETHER	410	410**
METHYLENE CHLORIDE	200	740
METHYLNAPHTHALENE, 2-(*1-)	1600	1600**
MOLYBDENUM	550	550
NAPHTHALENE	(1400) 1300	(1400) 1300
NICKEL	710	710
PENTACHLOROPHENOL	12	43
PETROLEUM HYDROCARBONS(gas/diesel)	5000	(10000) 5000
PETROLEUM HYDROCARBONS(heavy oils)	5000	(10000) 5000*
PHENANTHRENE	150	150
PHENOL	390	390
POLYCHLORINATED BIPHENYLS	25	N/V
PYRENE	250*	250*
SELENIUM	2500	2500
SILVER	240	240

SOIL CRITERIA FOR INORGANICS IN THIS TABLE APPLY ONLY WHERE SOIL pH IS 5.0 TO 11.0		
TABLE D:	Soil Remediation Criteria (ug/g)	
Chemical Compound	Residential/ Parkland Land Use	Industrial/ Commercial Land Use
STYRENE	(28) 16	(99) 16
TETRACHLOROETHANE, 1,1,1,2-	(2.9) 0.46	(2.9) 0.46
TETRACHLOROETHANE, 1,1,2,2-	(0.64) 0.22	(1.4) 0.22
TETRACHLOROETHYLENE	0.45^{a*}	0.45^{a*}
THALLIUM	32	150
TOLUENE	(1000) 510	(2500) 510
TRICHLOROBENZENE, 1,2,4-	770	770
TRICHLOROETHANE, 1,1,1-	34^{a**}	34^{a**}
TRICHLOROETHANE, 1,1,2-	3.1	12
TRICHLOROETHYLENE	3.9^{a**}	3.9^{a**}
TRICHLOROPHENOL, 2,4,5-	10^{*}	10^{*}
TRICHLOROPHENOL 2,4,6-	59	220
VANADIUM	910	910
VINYL CHLORIDE	(0.25) 0.094	(0.25). 0.094
XYLENES	(1000) 460	(2500) 460
ZINC	2500	5000
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A	N/A
CHLORIDE	N/V	N/V
NITRATE	N/V	N/V
NITRITE	N/V	N/V
SODIUM ADSORPTION RATIO (SAR)	N/A	N/A
SODIUM	N/V	N/V

( ) Criterion value in brackets applies to medium and fine textured soils.

* Criterion value is the same as the corresponding criterion in Table B.

** Criterion value is the same as the corresponding medium/fine textured soil criterion in Table B.

+ Boron soil criterion based on Hot Water Extract.

a Soil criterion adopted from Table C (potable groundwater situation) to account for degradation to vinyl chloride.

++ Analysis for methyl mercury is only required when the total mercury criterion is exceeded.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are present in the soil, the sum of the two concentrations cannot exceed the soil criterion.

N/A = Not applicable; N/V = No value.

Appendix A.1.5: Table E - Sediment Quality Criteria.

TABLE E: Sediment Quality Criteria

TABLE E:	Lowest Effect Level* (ug/g dry wt.)
Chemical Compound	All Land Use Categories
ACENAPHTHENE	*
ACENAPHTHYLENE	*
ACETONE	*
ALDRIN	0.002
ANTHRACENE	0.22
ANTIMONY	*
ARSENIC	6.0
BARIUM	*
BENZENE	*
BENZO(a)ANTHRACENE	0.32
BENZO(a)PYRENE	0.37
BENZO(b)FLUORANTHENE	*
BENZO(g,h,i)PERYLENE	0.17
BENZO(k)FLUORANTHENE	0.24
BERYLLIUM	*
BIPHENYL, 1,1-	*
BIS(2-CHLOROETHYL)ETHER	*
BIS(2-CHLOROISOPROPYL)ETHER	*
BIS(2-ETHYLHEXYL)PHTHALATE	*
BORON	*
BROMODICHLOROMETHANE	*
BROMOFORM	*
BROMOMETHANE	*
CADMIUM	0.6
CARBON TETRACHLORIDE	*
CHLORDANE	0.007
CHLOROANILINE, p-	*
CHLOROBENZENE	*
CHLOROFORM	*
CHLOROPHENOL, 2-	*
CHROMIUM (TOTAL)	26
CHROMIUM (VI)	*
CHRYSENE	0.34

TABLE E:	Lowest Effect Level[a] (ug/g dry wt.)
Chemical Compound	All Land Use Categories
COBALT	50[b]
COPPER	16
CYANIDE (FREE)	0.1[b]
DIBENZO(a,h)ANTHRACENE	0.06
DIBROMOCHLOROMETHANE	•
DICHLOROBENZENE, 1,2- (o-DCB)	•
DICHLOROBENZENE, 1,3- (m-DCB)	•
DICHLOROBENZENE, 1,4- (p-DCB)	•
DICHLOROBENZIDINE, 3,3'-	•
DDD	0.008
DDE	0.005
DDT	0.007
DICHLOROETHANE, 1,1-	•
DICHLOROETHANE, 1,2-	•
DICHLOROETHYLENE, 1,1-	•
DICHLOROETHYLENE, CIS-1,2-	•
DICHLOROETHYLENE, TRANS-1,2-	•
DICHLOROPHENOL, 2,4-	•
DICHLOROPROPANE, 1,2-	•
DICHLOROPROPENE, 1,3-	•
DIELDRIN	0.002
DIETHYL PHTHALATE	•
DIMETHYL PHTHALATE	•
DIMETHYLPHENOL, 2,4-	•
DINITROPHENOL, 2,4-	•
DINITROTOLUENE, 2,4-	•
DIOXIN/FURAN (ng TEQ/g sediment)	•
ENDOSULFAN	•
ENDRIN	0.003
ETHYLBENZENE	•
ETHYLENE DIBROMIDE	•
FLUORANTHENE	0.75
FLUORENE	0.19
HEPTACHLOR	•

TABLE E:	Lowest Effect Level[a] (ug/g dry wt.)
Chemical Compound	All Land Use Categories
HEPTACHLOR EPOXIDE	0.005[c]
HEXACHLOROBENZENE	0.02
HEXACHLOROBUTADIENE	•
HEXACHLOROCYCLOHEXANE, GAMMA	•
HEXACHLOROETHANE	•
INDENO(1,2,3-cd)PYRENE	0.2
LEAD	31
MERCURY	0.2
METHOXYCHLOR	•
METHYL ETHYL KETONE	•
METHYL ISOBUTYL KETONE	•
METHYL MERCURY	•
METHYL TERT BUTYL ETHER	•
METHYLENE CHLORIDE	•
METHYLNAPHTHALENE, 2-(1-)	•
MOLYBDENUM	•
NAPHTHALENE	•
NICKEL	16
PENTACHLOROPHENOL	•
PHENANTHRENE	0.56
PHENOL	•
POLYCHLORINATED BIPHENYLS	0.07
PYRENE	0.49
SELENIUM	•
SILVER	0.5[b]
STYRENE	•
TETRACHLOROETHANE, 1,1,1,2-	•
TETRACHLOROETHANE, 1,1,2,2-	•
TETRACHLOROETHYLENE	•
THALLIUM	•
TOLUENE	•
TOTAL PETROLEUM HYDROCARBONS (gas/diesel)	•
TOTAL PETROLEUM HYDROCARBONS (heavy oils)	•
TRICHLOROBENZENE, 1,2,4-	•

TABLE E:	Lowest Effect Level[a] (ug/g dry wt.)
Chemical Compound	All Land Use Categories
TRICHLOROETHANE, 1,1,1-	•
TRICHLOROETHANE, 1,1,2-	•
TRICHLOROETHYLENE	•
TRICHLOROPHENOL, 2,4,5-	•
TRICHLOROPHENOL 2,4,6-	•
VANADIUM	•
VINYL CHLORIDE	•
XYLENES	•
ZINC	120
ELECTRICAL CONDUCTIVITY (mS/cm)	N/A
CHLORIDE	•
NITRITE/NITRATE	•
SODIUM ADSORPTION RATIO (SAR)	N/A
SODIUM	•

[a] Lowest Effects Levels are based on the 5th percentile of the Screening Level Concentration(SLC) [b] Parameter was carried over from the Open Water Disposal Guidelines and is to be treated as a Lowest Effects Level.

[c] - 10% SLC.

• No value derived. N/A = Not Applicable.

Note: Criteria for the chemical compounds in the above table were taken from the MOEE Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (August, 1993). In the event of a discrepancy, sediment quality values found in the most recent version of the MOEE Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario should be deemed correct.

Appendix A.1.6: Table F - Ontario Background Soil Concentrations.

TABLE F: Ontario Background Soil Concentrations

TABLE F:	Soil Background Concentration (ug/g)	
Chemical Compound	Agricultural Land Use	All Other Land Uses
ACENAPHTHENE	0.05	0.07
ACENAPHTHYLENE	0.08	0.08
ACETONE	•	•
ALDRIN	0.05	0.05
ANTHRACENE	0.05	0.16
ANTIMONY	1.0	1.0
ARSENIC	14	17
BARIUM	190	210
BENZENE	0.002	0.002
BENZO(a)ANTHRACENE	0.10	0.74
BENZO(a)PYRENE	0.10	0.49
BENZO(b)FLUORANTHENE	0.30	0.47
BENZO(g,h,i)PERYLENE	0.20	0.68
BENZO(k)FLUORANTHENE	0.05	0.48
BERYLLIUM	1.2	1.2
BIPHENYL, 1,1-	•	•
BIS(2-CHLOROETHYL)ETHER	•	•
BIS(2-CHLOROISOPROPYL)ETHER	•	•
BIS(2-ETHYLHEXYL)PHTHALATE	•	•
BROMODICHLOROMETHANE	•	•
BROMOFORM	0.002	0.002
BROMOMETHANE	0.003	0.003
CADMIUM	1.0	1.0
CARBON TETRACHLORIDE	0.002	0.002
CHLORDANE	0.05	0.05
CHLOROANILINE, p-	•	•
CHLOROBENZENE	0.002	0.002
CHLOROFORM	0.006	0.006
CHLOROPHENOL, 2-	0.1	0.1
CHROMIUM (TOTAL)	67	71
CHROMIUM (VI)	2.5	2.5
CHRYSENE	0.18	0.69
COBALT	19	21

TABLE F:	Soil Background Concentration (ug/g)	
Chemical Compound	Agricultural Land Use	All Other Land Uses
COPPER	56	85
CYANIDE (FREE)	0.12	0.12
DIBENZO(a,h)ANTHRACENE	0.15	0.16
DIBROMOCHLOROMETHANE	0.003	0.003
DICHLOROBENZENE, 1,2- (o-DCB)	0.002	0.002
DICHLOROBENZENE, 1,3- (m-DCB)	0.002	0.002
DICHLOROBENZENE, 1,4- (p-DCB)	0.002	0.002
DICHLOROBENZIDINE, 3,3'-	•	•
DDD	•	•
DDE	•	•
DDT	0.12	1.4
DICHLOROETHANE, 1,1-	0.002	0.002
DICHLOROETHANE, 1,2-	0.002	0.002
DICHLOROETHYLENE, 1,1-	0.002	0.002
DICHLOROETHYLENE, CIS-1,2-	•	•
DICHLOROETHYLENE, TRANS-1,2-	0.003	0.003
DICHLOROPHENOL, 2,4-	0.1	0.1
DICHLOROPROPANE, 1,2-	0.002	0.002
DICHLOROPROPENE, 1,3-	0.003	0.003
DIELDRIN	0.05	0.05
DIETHYL PHTHALATE	•	•
DIMETHYL PHTHALATE	•	•
DIMETHYLPHENOL, 2,4-	0.2	0.2
DINITROPHENOL, 2,4-	0.2	0.2
DINITROTOLUENE, 2,4-	•	•
DIOXIN/FURAN (ng TEQ/g soil)	0.007	0.007
ENDOSULFAN	•	•
ENDRIN	0.05	0.05
ETHYLBENZENE	0.002	0.002
ETHYLENE DIBROMIDE	0.004	0.004
FLUORANTHENE	0.24	1.1
FLUORENE	0.05	0.12
HEPTACHLOR	0.05	0.05
HEPTACHLOR EPOXIDE	0.05	0.05

TABLE F:	Soil Background Concentration (ug/g)	
Chemical Compound	Agricultural Land Use	All Other Land Uses
HEXACHLOROBENZENE	•	•
HEXACHLOROBUTADIENE	•	•
HEXACHLOROCYCLOHEXANE, GAMMA	•	•
HEXACHLOROETHANE	•	•
INDENO(1,2,3-cd)PYRENE	0.11	0.38
LEAD	55	120
MERCURY	0.16	0.23
METHOXYCHLOR	0.05	0.05
METHYL ETHYL KETONE	•	•
METHYL ISOBUTYL KETONE	•	•
METHYL MERCURY	•	•
METHYL TERT BUTYL ETHER	•	•
METHYLENE CHLORIDE	0.003	0.003
METHYLNAPHTHALENE, 1-	0.05	0.26
METHYLNAPHTHALENE, 2-	0.05	0.29
MOLYBDENUM	2.5	2.5
NAPHTHALENE	0.05	0.09
NICKEL	43	43
PENTACHLOROPHENOL	0.1	0.1
PETROLEUM HYDROCARBONS(gas/diesel)	•	•
PETROLEUM HYDROCARBONS(heavy oils)	•	•
PHENANTHRENE	0.19	0.69
PHENOL	0.1	0.1
POLYCHLORINATED BIPHENYLS	0.3	0.3
PYRENE	0.19	1.0
SELENIUM	1.4	1.9
SILVER	0.35	0.42
STYRENE	0.002	0.002
TETRACHLOROETHANE, 1,1,1,2-	•	•
TETRACHLOROETHANE, 1,1,2,2-	0.004	0.004
TETRACHLOROETHYLENE	0.002	0.002
THALLIUM	2.5	2.5
TOLUENE	0.002	0.002
TRICHLOROBENZENE, 1,2,4-	•	•

TABLE F:	Soil Background Concentration (ug/g)	
Chemical Compound	Agricultural Land Use	All Other Land Uses
TRICHLOROETHANE, 1,1,1-	0.008	0.009
TRICHLOROETHANE, 1,1,2-	0.002	0.002
TRICHLOROETHYLENE	0.004	0.004
TRICHLOROPHENOL, 2,4,5-	0.1	0.1
TRICHLOROPHENOL 2,4,6-	0.1	0.1
VANADIUM	91	91
VINYL CHLORIDE	0.003	0.003
XYLENES	0.002	0.002
ZINC	150	160
ELECTRICAL CONDUCTIVITY (mS/cm)	0.47	0.57
CHLORIDE	58	330
NITROGEN (TOTAL %)	0.7	0.7
NITRITE/NITRATE	40	61
SODIUM ADSORPTION RATIO (SAR)	1.0	2.4

Note: * No value derived.

Appendix A.2: Summary Tables of Criteria Components for Soil and Groundwater

This section provides a series of summary tables which outline the specific components used to develop each chemical parameter criterion in Table A to D. For each chemical parameter, the value in the shaded cell is the one selected to be the criterion for that chemical. Explanations for the headings and abbreviations used in the component summary tables are as follows:

Explanation of Column Headings Used in the Soil Criteria Component Summary Tables

MOEE -	Ontario Ministry of Environment and Energy.
SOIL MDL -	MOEE Laboratory Services Branch method detection limits for contaminants in soils.
MASS. -	Commonwealth of Massachusetts.
PQL -	Massachusetts Practical Quantification Limits for contaminants in soils.
ONT. -	Province of Ontario.
SOIL BKGRD. -	Ontario soil background levels developed from Ontario Typical Range (OTR) values.
CEILING VALUE -	Ceiling concentration in soil set by Massachusetts according to each soil category: Category S-1: 100 ug/g for volatile organics, 500 ug/g for semi-volatile organics and 1000 ug/g for all other chemicals. Category S-2: 500 ug/g for volatile organics, 1000 ug/g for semi-volatile organics and 2500 ug/g for all other chemicals. Category S-3: 500 ug/g for volatile organics, 1000 ug/g for semi-volatile organics, 2500 ug/g for very low volatile organics and 5000 ug/g for all other chemicals
ECOTOXICITY CRITERIA -	Soil remediation criteria developed for protection of ecological receptors.
MOEE (ECOTOX.) -	Current coarse texture and medium/fine texture soil clean-up guidelines based on protection of vegetation and/or grazing animals. Criteria were adopted from either the agricultural/residential/parkland category or commercial/industrial category.
Neth.C (ECOTOX.) -	Netherlands "C Level" soil clean-up guidelines for residential landuse, based on complete protection of 50% of ecosystem species.
SUBSTITUTE CRITERIA -	Existing soil remediation criteria developed by MOEE or adopted from other Canadian jursidictions.
SOIL CONTACT	Effects-based soil concentrations determined for exposure of both children and adults to incidental ingestion and dermal contact with soils and dust. Values are derived using the Massachusetts MCP standards approach. Human health toxicity data derived by MOEE Standard Development Branch staff was used for several inorganics not delt with by Massachusetts; i.e. barium, cobalt, copper, molybdenum and vanadium.

S1 Risk -	Cancer/noncancer risk concentration for soil category 1 based upon sensitive uses of a property and accessible soil, either currently or in the foreseeable future. Concentrations in this category are based upon a residential exposure scenario where a potential child receptor may have direct contact with contaminated soil.
S2 Risk -	Cancer/noncancer risk concentration for soil category based upon property uses associated with moderate exposure and accessible soils, either currently or in the forseeable future. Concentrations are based on an exposure scenario where a potential adult receptor may come in contact with contaminated soil in a work environment or passive recreational setting.
S3 Risk -	Cancer/noncancer risk concentration soil category based upon restricted access to property and soil with limited potential for exposure, either currently or in the foreseeable future. Concentrations based upon an exposure scenario where an adult receptor may come into contact with contaminated soil during a short but intense exposure such as excavation work.
SOIL LEACHING (Mod. Mass.)	Effects-based soil concentrations derived for the protection of groundwater due to leaching from soils. Protection of human health from direct soil contact is also provided. Values are derived using the Dilution/Attenuation Factor equation of the Massachusetts MCP standards approach. The approach was modified by using Ontario soil background concentrations, MOEE soil and water method detection limits, USEPA Ambient Water Quality Criteria for fresh water only, and fresh water lowest observable effects data from the AQUIRE database. Leaching-based soil concentrations are derived from the lowest value determined for direct soil contact (S1, S2, or S3) and the leaching-based value required for protection of ground water as drinking water, protection against migration of volatile organic contaminants from groundwater into indoor air, or protection against potential impacts of groundwater discharging to surface water.
S-/GW1 -	Leaching-based soil remediation concentration, in S1, S2 or S3 soil, to protect human health against direct soil contact and to protect groundwater as drinking water, either currently or in the forseeable future (MCP Stds.).
S-/GW2 -	Leaching-based soil remediation concentration, in S1, S2 or S3 soil, to protect human health against direct soil contact and to protect against potential for volatile materials to migrate from groundwater into indoor air, either currently or in the forseeable future (MCP Stds.).
S-/GW3 -	Leaching-based soil remediation concentration, in S1, S2 or S3 soil, to protect human health against direct soil contact and to protect against potential impacts of groundwater discharging to surface water (MCP Stds.).

SOIL TO INDOOR AIR

S/IA -	Concentrations in this category are based upon the potential for volatile organics to migrate directly from soil to indoor air.

Abbreviations Used in the Soil Remediation Component Summary Tables

C - Cancer risk-based concentration (Massachusetts MCP Stds.)

CCME - Canadian Council of Ministers of the Environment

MOEE 1 - Health-based lead criteria developed by MOEE Standards Development Branch.

MOEE 2 - MOEE Interim Petroleum Contaminated Sites Remediation Criterion for TPH
Level 1 = 100 ug/g, Level 2 = 1000 ug/g, Level 3 = 5000 ug/g.

Nc - Non cancer effects-based concentration (Massachusetts MCP Stds.)

Shl/Tex - Value was derived from criterion determined for benzo(a)pyrene by the Interministry Committee on Clean-up for the Shell, Oakville and Texaco, Port Credit, refinery properties.

Tbl A^a - Soil criterion from Table A (surface soil - potable groundwater) adopted to account for degradation of chlorinated ethylenes to vinyl chloride.

Tbl C^a - Soil criterion from Table C (sub-surface soil - potable groundwater) adopted to account for degradation of chlorinated ethylenes to vinyl chloride.

Explanation of Column Headings in the Groundwater Criteria Component Summary Tables

MDL-MOEE - MOEE Laboratory Services Branch Method Detection Limits for contaminants in water.

MDL Basis - MDL is based on drinking water or MISA or is adopted from Massachusetts.

SOLUBILITY (1/2) - 50% of solubility concentration in water (ug/L).

CEILING VALUE - Ceiling concentration for chemical in water (0.005%) set by Massachusetts.

GW1 - Concentrations in this category are based upon the use of groundwater as drinking water, either currently or in the forseeable future.

GW2 - Concentrations in this category are based upon the potential for volatile materials to migrate to indoor air.

GW3 - Concentrations in this category are based upon potential environmental impacts of contaminated groundwater to surface water.

SUBSTITUTE NOs. - Groundwater criterion from Table A (surface soil - potable groundwater) adopted to account for degradation of chlorinated ethylenes to vinyl chloride.

BASIS (for above) - Basis for Table A groundwater criterion adopted in Table B.

Abbreviations Used in the Groundwater Remediation Component Summary Tables

AIR BACKGROUND - Normal background levels of contaminant in indoor air.

AWQC - USEPA fresh water ambient water quality criteria (chronic or acute).

Cancer Risk - Cancer risk-based concentration (Massachusetts MCP Stds.)

DW - Method detection limit for chemical parameters in Ontario drinking water.

LOEL - Lowest observable effects levels for freshwater organisms from the Aquatic Information and Retrieval (AQUIRE) system.

MASS. - Practical quantification limit established by Massachusetts.

MISA - Method detection limit for Ontario Municipal/Industrial Strategy for Abatement program.

MMCL - Drinking water standard established by Massachusetts.

Noncancer Risk - Non cancer risk-based concentration (Massachusetts MCP Stds.)

Odour - 50% odour detection threshold

ODWO - Ontario Drinking Water Objective.

ORSGL - Guideline developed by Massachusetts Dept. Environmental Protection, Office of Research and Standards, Division of Water Supply.

Volatility Risk - Groundwater concentration above which migration to indoor air has the potential to cause cancer or non-cancer risk-based concentrations in indoor air.

Appendix A.2.1: Table A Criteria Components - Coarse Textured Soil (Surface/Full Depth) - Potable Groundwater Situation

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS													
COARSE TEXTURED SOILS	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Nath. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.05	1000					1400 nc	**15**		1300	
ACENAPHTHYLENE	0.05		0.08	**100**					1000 nc	130		840	
ACETONE		0.1		500					3400 nc	**3.5**	58	3.8	1900
ALDRIN	**0.05**		0.05	1000		0.35			0.026 c	0.08	1.6	69	0.15
ANTHRACENE	0.05		0.05	1000		40			5300 nc	1500		**28**	
ANTIMONY	1		1	1000	20				**13 nc**				
ARSENIC	1		14	1000	**20**								
BARIUM'	2.5		190	1000	**750**				3700 nc				
BENZENE	0.002		0.002	500		25			35 c	**0.24**	(0.48) 89	2400	(0.031) 5.3
BENZO(a)ANTHRACENE	0.05		0.1	1000		40	120	Shl/Tex		**6.6**		170	
BENZO(a)PYRENE	0.05		0.1	1000		40	**1.2**	Shl/Tex		9.0	1700	1700	49000
BENZO(b)FLUORANTHENE	0.05		0.3	1000			**12**	Shl/Tex		18		640	
BENZO(g,h,i)PERYLENE	0.1		0.2	1000		**40**	120	Shl/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.05	1000		40	**12**	Shl/Tex		18		37	
BERYLLIUM	0.5		**1.2**	1000	4				0.37 c				
BIPHENYL, 1,1-		0.05		1000					1900 nc	**0.89**		4.3	
BIS(2-CHLOROETHYL)ETHER		**0.66**		500					0.12 c	0.01	0.25	110	0.13
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		500					1.9 c	0.02	4.7	540	0.82
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					130 c	**100**	11000	500	1000000
BORON (Available)'					**1.5**								
BROMODICHLOROMETHANE		0.005		100					14 c	**0.12**		1200	
BROMOFORM	0.002		0.002	500					110 c	**0.11**	19	1100	2.3
BROMOMETHANE	0.003		0.003	500					47 nc	12	4.5	3900	**0.061**
CADMIUM ''	1		1	1000	**3**				14 nc				
CARBON TETRACHLORIDE	0.002		0.002	500					6.8 c	1.0	(0.28) 3.3	10000	**(0.0068) 0.1**
CHLORDANE	0.05		0.05	1000					0.99 c	5.1	200	**0.29**	18
CHLOROANILINE, p-		**1.3**		100					130 nc	0.3		1.1	
CHLOROBENZENE	0.002		0.002	500		30			670 nc	**2.4**	(32) 99	40	(3.2) 8
CHLOROFORM	0.002		0.006	500					140 c	**0.13**	(0.21) 11	330	(0.011) 0.79
CHLOROPHENOL, 2-	**0.1**		0.1	1000		10			95 nc	0.0055		800	
CHROMIUM (Total)	5		67	1000	**750**								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc				
CHROMIUM (VI)	2.5		2.5	1000	**8**				180 nc				
CHRYSENE	0.05		0.18	1000		40	**12**	Sh/Tex		17		100	
COBALT'	2 5		19	1000	**40**				2700 nc				
COPPER'	5		56	1000	**150**				1100 nc				
CYANIDE (Free)	0.05		0.12	100					**100 nc**	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.15	1000			**1.2**	Sh/Tex		110		140	
DIBROMOCHLOROMETHANE	0 003		0 003	100					10 c	**0.09**		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	**0.88**	3000	2300	270
DICHLOROBENZENE, 1,3- (m-DCB)	0 002		0 002	100		**30**			3000 nc	190		2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0 002		0 002	500		30			37 c	**0.32**	9200	2400	830
DICHLOROBENZIDINE, 3,3'-		**1.3**		1000					0.51 c	21		400	
DDD	0 05			1000					**2.2 c**	3900		780	
DDE	0 01			1000		4			**1.6 c**	22000		15000	
DDT	0 05		0.12	1000		4			**1.6 c**	1200	62	2 0	470
DICHLOROETHANE, 1,1-	0.002		0 002	100					2600 nc	**3.0**	390	2200	22
DICHLOROETHANE, 1,2-	0 002		0 002	500		60			9.6 c	0 05	0.16	460	**0.022**
DICHLOROETHYLENE, 1,1-	0.002		0 002	500					1.4 c	0.72	0.07	5200	**0.0024**
DICHLOROETHYLENE, CIS-1,2-		0.005		100					340 nc	**2.3**		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0 003	500					670 nc	**4,1**		2100	
DICHLOROPHENOL, 2,4-	0 01		0.1	100		10			41 nc	**0.3**		3700	
DICHLOROPROPANE, 1,2-	0.002		0 002	100					7.9 c	0.13	0.23	1300	**0.019**
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	0 04	0.10	63	**0.0066**
DIELDRIN	**0.05**		0.05	1000		4			0.028 c	0.025	2 2	0 025	0.21
DIETHYL PHTHALATE		0 66		1000					44000 nc	130		**0.71**	
DIMETHYL PHTHALATE		0 66		1000					39000 nc	1200		**0.7**	
DIMETHYLPHENOL, 2,4-	0 2		0 2	1000					380 nc	**0.94**		140	
DINITROPHENOL, 2,4-	**0.2**		0 2	1000					38 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		**0.66**		1000					1.1 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0 002		0 007				**0.01**	CCME					
ENDOSULFAN	0 04			1000					140 nc	**0.18**		0.29	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc	0.56		0.014	
ETHYLBENZENE	0.002		0.002	500					2300 nc	0.28	3300	5800	290
ETHYLENE DIBROMIDE	0.004		0.004	100					0.01 c	0.012	0.038	320	0.0056
FLUORANTHENE	0.05		0.24	1000		40			910 nc	840		840	
FLUORENE	0.05		0.05	1000					910 nc	340		350	
HEPTACHLOR	0.05		0.05	1000					0.12 c	11	0.91	0.15	0.084
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	12	23	680	2.1
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	200	130	7300	11
HEXACHLOROBUTADIENE	0.01			100					6.9 c	2.2	4.3	460	0.39
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c	2.5		0.49	
HEXACHLOROETHANE	0.01			100					6.3 nc	8.5	42	18000	3.8
INDENO(1,2,3-cd)PYRENE	0.1		0.11	1000		40	12	Shl/Tex		53		70	
LEAD	10		55	1000		200	200	MOEE 1					
MERCURY	0.05		0.16	1000		10			13 nc				
METHOXYCHLOR	0.05		0.05	1000					110 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	0.27	38	38	1700
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	0.48	69	69	58
METHYL MERCURY				1000		10			6.8 nc				
METHYL TERT BUTYL ETHER		0.05		100					170 nc	5.7	410	410	120
METHYLENE CHLORIDE	0.003		0.003	500					120 c	1.1	1100	1100	140
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.05	1000					1300 nc	1.2	1600	1600	280
MOLYBDENUM*	2.5		2.5	1000	5				170 nc				
NAPHTHALENE	0.05		0.05	100		40			1300 nc	4.6	1300	1400	120
NICKEL	2.5		43	1000	150				310 nc				
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.9 c	160	13000	680	1200
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0.19	1000		40	120	Shl/Tex		720		150	
PHENOL	0.1		0.1	500		40			11000 nc	64	760	390	46000
POLYCHLORINATED BIPHENYLS	0.3		0.3				0.5	CCME					
PYRENE	0.05		0.19	1000					680 nc	500		250	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.4	1000	2				320 nc				
SILVER	0.25		0.35	1000	20				98 nc				
STYRENE	0.002		0.002	500					18 c	1.7	(6.7) 16	840	(0.43) 1.2
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	0.39	0.46	3900	0.019
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	0.01	0.22	240	0.037
TETRACHLOROETHYLENE	0.002		0.002	500		60			170 c	0.45	(45) 240	760	(3.8) 22
THALLIUM	2.5		2.5	1000					4.1 nc				
TOLUENE	0.002		0.002	500		150			6100 nc	2.1	510	4300	34
TPH - refer to PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	110	950	770	87
TRICHLOROETHANE, 1,1,1-	0.002		0.008	100					3000 nc	34	720	8500	26
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	0.28	(1.7) 920	2900	(0.19) 92
TRICHLOROETHYLENE	0.004		0.004	100		60			67 nc	3.9	(2.3) 21	3900	(0.12) 1.1
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	0.66	12000	3200	1100
VANADIUM*	5		91	1000	200				470 nc				
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.38	0.094	100	0.0012
XYLENES	0.002		0.002	500					61000 nc	25	460	4100	34
ZINC	25		150	1000	600				16000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.47		0.7								
CHLORIDE***	0.25		58										
NITRATE***	5		40										
NITRITE***	5		40										
SODIUM ADSORPTION RATIO (SAR)			1		5								
SODIUM***	25												

c Cancer Risk nc Noncancer Risk

+ S-1 Risk Value determined from human health toxicity data derived by MOEE Standard Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** MOEE Soil Clean-up Guideline (SCUG) for cadmium (coarse textured soil) is based on human health, but is applied here for the protection of grazing animals. *** Soil criterion is not available.

( ) Value in brackets is based on meeting indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	1000					1400 nc	**15**		1300	
ACENAPHTHYLENE	0.05		0.08	**100**					1000 nc	130		840	
ACETONE		0.1		500					3400 nc	**3.5**	58	3 8	1900
ALDRIN	**0.05**		0 05	1000		0.35			0.026 c	0 08	1 6	69	0.15
ANTHRACENE	0.05		0.16	1000		40			5300 nc	1500		**28**	
ANTIMONY	1		1	1000	20				**13 nc**				
ARSENIC	1		17	1000	**20**								
BARIUM'	2.5		210	1000	**750**				3700 nc				
BENZENE	0.002		0 002	500		25			35 c	**0.24**	(0.48) 89	2400	(0.031) 5.3
BENZO(a)ANTHRACENE	0 05		0.74	1000		40	120	Shl/Tex		**6.6**		170	
BENZO(a)PYRENE	0.05		0.49	1000		40	**1.2**	Shl/Tex		9 0	1700	1700	49000
BENZO(b)FLUORANTHENE	0.05		0.47	1000			**12**	Shl/Tex		18		640	
BENZO(g,h,i)PERYLENE	0.1		0.68	1000		**40**	120	Shl/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.48	1000		40	**12**	Shl/Tex		18		37	
BERYLLIUM	0.5		**1.2**	1000	4				0.37 c				
BIPHENYL, 1,1-		0.05		1000					1900 nc	**0.89**		4.3	
BIS(2-CHLOROETHYL)ETHER		**0.66**		500					0.12 c	0 01	0.25	110	0.13
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		500					1.9 c	0.02	4.7	540	0.82
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					130 c	**100**	11000	500	1000000
BORON (Available)'					**1.5**								
BROMODICHLOROMETHANE		0.005		100					14 c	**0,12**		1200	
BROMOFORM	0.002		0 002	500					110 c	**0.11**	19	1100	2 3
BROMOMETHANE	0.003		0 003	500					47 nc	12	4 5	3900	**0.061**
CADMIUM	1		1	1000		**12**			14 nc				
CARBON TETRACHLORIDE	0 002		0 002	500					6.8 c	1.0	(0.28) 3.3	10000	(0.0068) **0.1**
CHLORDANE	0.05		0 05	1000					0.99 c	5.1	200	**0.29**	18
CHLOROANILINE, p-		**1.3**		100					130 nc	0.3		1 1	
CHLOROBENZENE	0 002		0 002	500		30			670 nc	**2.4**	(32) 99	40	(3 2) 8
CHLOROFORM	0 002		0 006	500					140 c	**0.13**	(0.21) 11	330	(0 011) 0.79
CHLOROPHENOL, 2-	**0.1**		0.1	1000		10			95 nc	0 0055		800	
CHROMIUM (Total)	5		71	1000	**750**								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc				
CHROMIUM (VI)	2.5		2.5	1000	**8**				180 nc				
CHRYSENE	0.05		0.69	1000		40	**12**	Shl/Tex		17		100	
COBALT'	2.5		21	1000	**40**				2700 nc				
COPPER'	5		85	1000	**225**				1100 nc				
CYANIDE (Free)	0.05		0.12	100					**100 nc**	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	1000			**1.2**	Shl/Tex		110		140	
DIBROMOCHLOROMETHANE	0.003		0.003	100					10 c	**0.09**		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	**0.88**	3000	2300	270
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	100		**30**			3000 nc	190		2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	500		30			37 c	**0.32**	9200	2400	830
DICHLOROBENZIDINE, 3,3'-		**1.3**		1000					0.51 c	21		400	
DDD	0.05			1000					**2.2 c**	3900		780	
DDE	0.01			1000		4			**1.6 c**	22000		15000	
DDT	0.05		1.4	1000		4			**1.6 c**	1200	62	2.0	470
DICHLOROETHANE, 1,1-	0.002		0.002	100					2600 nc	**3.0**	390	2200	22
DICHLOROETHANE, 1,2-	0.002		0.002	500		60			9.6 c	0.05	0.16	460	**0.022**
DICHLOROETHYLENE, 1,1-	0.002		0.002	500					1.4 c	0.72	0.07	5200	**0.0024**
DICHLOROETHYLENE, CIS-1,2-		0.005		100					340 nc	**2.3**		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	500					670 nc	**4.1**		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	100		10			41 nc	**0.3**		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	100					7.9 c	0.13	0.23	1300	**0.019**
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	0.04	0.10	63	**0.0066**
DIELDRIN	**0.05**		0.05	1000		4			0.028 c	0.025	2.2	0.025	0.21
DIETHYL PHTHALATE		0.66		1000					44000 nc	130		**0.71**	
DIMETHYL PHTHALATE		0.66		1000					39000 nc	1200		**0.7**	
DIMETHYLPHENOL, 2,4-	0.2		0.2	1000					380 nc	**0.94**		140	
DINITROPHENOL, 2,4-	**0.2**		0.2	1000					38 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		**0.66**		1000					1.1 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				**1**	CCME					
ENDOSULFAN	0.04			1000					140 nc	**0.18**		0.29	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc	0.56		0.014	
ETHYLBENZENE	0.002		0.002	500					2300 nc	0.28	3300	5800	290
ETHYLENE DIBROMIDE	0.004		0.004	100					0.01 c	0.01	0.038	320	0.0056
FLUORANTHENE	0.05		1.1	1000		40			910 nc	840		840	
FLUORENE	0.05		0.12	1000					910 nc	340		350	
HEPTACHLOR	0.05		0.05	1000					0.12 c	11	0.91	0.15	0.084
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	12	23	680	2.1
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	200	130	7300	11
HEXACHLOROBUTADIENE	0.01			100					6.9 c	2.2	4.3	460	0.38
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c	2.5		0.49	
HEXACHLOROETHANE	0.01			100					6.3 nc	8.5	42	18000	3.8
INDENO(1,2,3-cd)PYRENE	0.1		0.38	1000		40	12	Sh/Tex		53		70	
LEAD	10		120	1000		200	200	MOEE 1					
MERCURY	0.05		0.23	1000		10			13 nc				
METHOXYCHLOR	0.05		0.05	1000					110 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	0.27	38	38	1700
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	0.48	69	69	58
METHYL MERCURY				1000		10			6.8 nc				
METHYL TERT BUTYL ETHER		0.05		100					170 nc	5.7	410	410	120
METHYLENE CHLORIDE	0.003		0.003	500					120 c	1.1	1100	1100	140
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	1000					1300 nc	1.2	1600	1600	280
MOLYBDENUM*	2.5		2.5	1000	40				170 nc				
NAPHTHALENE	0.05		0.09	100		40			1300 nc	4.6	1300	1400	120
NICKEL	2.5		43	1000	150				310 nc				
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.9 c	160	13000	680	1200
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0.69	1000		40	120	Sh/Tex		720		150	
PHENOL	0.1		0.1	500		40			11000 nc	64	760	390	46000
POLYCHLORINATED BIPHENYLS	0.3		0.3				5	CCME					
PYRENE	0.05		1	1000					680 nc	500		250	

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COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Nath. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	1000	10				320 nc				
SILVER	0.25		0.42	1000	20				98 nc				
STYRENE	0.002		0.002	500					18 c	1.7	(6.7) 16	840	(0.43) 1.2
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	0.39	0.46	3900	0.019
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	0.01	0.22	240	0.037
TETRACHLOROETHYLENE	0.002		0.002	500		60			170 c	0.45	(45) 240	760	(3.8) 22
THALLIUM	2.5		2.5	1000					4.1 nc				
TOLUENE	0.002		0.002	500		150			6100 nc	2.1	510	4300	34
TPH - refer to PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	110	950	770	87
TRICHLOROETHANE, 1,1,1-	0.002		0.009	100					3000 nc	34	720	8500	26
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	0.28	(1.7) 920	2900	(0.19) 92
TRICHLOROETHYLENE	0.004		0.004	100		60			67 nc	3.9	(2.3) 21	3900	(0.12) 1.1
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	0.66	12000	3200	1100
VANADIUM*	5		91	1000	200				470 nc				
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.38	0.094	100	0.001
XYLENES	0.002		0.002	500					61000 nc	25	460	4100	34
ZINC	25		160	1000	600				16000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		0.7								
CHLORIDE**	0.25		330										
NITRATE**	5		61										
NITRITE**	5		61										
SODIUM ADSORPTION RATIO (SAR)			2.4		5								
SODIUM**	25												

c Cancer Risk nc Noncancer Risk

+ S1 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

( ) Value in brackets is based on meeting indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in soil, the sum of the two concentrations cannot exceed the soil criterion.

** Soil criterion not available.

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	2500					3600 nc	**15**		1300	
ACENAPHTHYLENE	0.05		0.08	2500					2700 nc	**130**		840	
ACETONE		0.1		1000					11000 nc	**3.5**	58	3.8	1900
ALDRIN	**0.05**		0.05	2500		0.35			0.04 c	0.08	1.6	69	0.15
ANTHRACENE	0.05		0.16	2500		40			13000 nc	1500		**28**	
ANTIMONY	1		1	2500	**40**				44 nc				
ARSENIC	1		17	2500	**40**								
BARIUM'	2.5		210	2500	**1500**				8700 nc				
BENZENE	0.002		0.002	1000		25			63 c	**0.24**	(0.48) 89	2400	(0.031) 5.3
BENZO(a)ANTHRACENE	0.05		0.74	2500		40	190	Shl/Tex		**6.6**		170	
BENZO(a)PYRENE	0.05		0.49	2500		40	**1.9**	Shl/Tex		9.0	1700	1700	49000
BENZO(b)FLUORANTHENE	0.05		0.47	2500			19	Shl/Tex		**18**		640	
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		**40**	190	Shl/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.48	2500		40	19	Shl/Tex		**18**		37	
BERYLLIUM	0.5		**1.2**	2500	8				0.85 c				
BIPHENYL, 1,1-		0.05		2500					6600 nc	**0.89**		4.3	
BIS(2-CHLOROETHYL)ETHER		**0.66**		1000					0.16 c	0.01	0.25	110	0.13
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		1000					2.6 c	0.02	4.7	540	0.82
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500					330 c	**100**	11000	500	1000000
BORON (Available)'					**2**								
BROMODICHLOROMETHANE		0.005		500					25 c	**0.12**		1200	
BROMOFORM	0.002		0.002	1000					190 c	**0.11**	19	1100	2.3
BROMOMETHANE	0.003		0.003	1000					150 nc	12	4.5	3900	**0.061**
CADMIUM	1		1	2500		**12**			41 nc				
CARBON TETRACHLORIDE	0.002		0.002	1000					12 c	1.0	(0.28) 3.3	10000	**(0.0068) 0.1**
CHLORDANE	0.05		0.05	2500					2.0 c	5.1	200	**0.29**	18
CHLOROANILINE, p-		**1.3**		2500					440 nc	0.3		1.1	
CHLOROBENZENE	0.002		0.002	1000		30			2200 nc	**2.4**	(32) 99	40	(3.2) 8
CHLOROFORM	0.002		0.006	1000					250 c	**0.13**	(0.21) 11	330	(0.011) 0.79
CHLOROPHENOL, 2-	**0.1**		0.1	2500		10			240 nc	0.0055		800	
CHROMIUM (Total)	5		71	2500	**750**								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		2500		230			220000 nc				
CHROMIUM (VI)	2.5		2.5	2500	8				600 nc				
CHRYSENE	0.05		0.69	2500		40	19	Shl/Tex		17		100	
COBALT'	2.5		21	2500	80				7200 nc				
COPPER'	5		85	2500	225				3400 nc				
CYANIDE (Free)	0.05		0.12	500					100 nc	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500			1.9	Shl/Tex		110		140	
DIBROMOCHLOROMETHANE	0.003		0.003	500					18 c	0.09		830	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500		30			9900 nc	0.88	3000	2300	270
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500		30			9900 nc	190		2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000		30			63 c	0.32	9200	2400	830
DICHLOROBENZIDINE, 3,3'-		1.3		2500					0.72 c	21		400	
DDD	0.05			2500					3.5 c	3900		780	
DDE	0.01			2500		4			2.4 c	22000		15000	
DDT	0.05		1.4	2500		4			2.4 c	1200	62	2.0	470
DICHLOROETHANE, 1,1-	0.002		0.002	500					8500 nc	3.0	390	2200	22
DICHLOROETHANE, 1,2-	0.002		0.002	1000		60			17 c	0.05	0.16	460	0.022
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000					2.5 c	0.72	0.07	5200	0.0024
DICHLOROETHYLENE, CIS-1,2-		0.005		500					1100 nc	2.3		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000					2200 nc	4.1		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	2500		10			84 nc	0.3		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	500					12 c	0.13	0.23	1300	0.019
DICHLOROPROPENE, 1,3-	0.003		0.003	1000					4.6 c	0.04	0.10	63	0.0066
DIELDRIN	0.05		0.05	2500		4			0.04 c	0.025	2.2	0.025	0.21
DIETHYL PHTHALATE		0.66		2500					270000 nc	130		0.71	
DIMETHYL PHTHALATE		0.66		2500					150000 nc	1200		0.7	
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500					940 nc	0.94		140	
DINITROPHENOL, 2,4-	0.2		0.2	2500					94 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		0.66		2500					1.8 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				1	CCME					
ENDOSULFAN	0.04			2500					360 nc	0.18		0.29	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	2500		0.06			15 nc	0.56		0.014	
ETHYLBENZENE	0.002		0.002	1000					6000 nc	0.28	3300	5800	290
ETHYLENE DIBROMIDE	0.004		0.004	500					0.02 c	0.012	0.038	320	0.0056
FLUORANTHENE	0.05		1.1	2500		40			2400 nc	840		840	
FLUORENE	0.05		0.12	2500					2400 nc	340		350	
HEPTACHLOR	0.05		0.05	2500					0.18 c	11	0.91	0.15	0.084
HEPTACHLOR EPOXIDE	0.05		0.05	2500					0.09 c	12	23	680	2.1
HEXACHLOROBENZENE	0.01			2500		30			0.76 c	200	130	7300	11
HEXACHLOROBUTADIENE	0.01			2500					11 c	2.2	4.3	460	0.38
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500		2			0.64 c	2.5		0.49	
HEXACHLOROETHANE	0.01			2500					13 c	8.5	42	18000	3.8
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		40	19	Shl/Tex		53		70	
LEAD	10		120	2500			1000	MOEE 1					
MERCURY	0.05		0.23	2500		10			57 nc				
METHOXYCHLOR	0.05		0.05	2500					300 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		1000					66000 nc	0.27	38	38	1700
METHYL ISOBUTYL KETONE		0.05		500					5500 nc	0.48	69	69	58
METHYL MERCURY **				2500		10			18 nc				
METHYL TERT BUTYL ETHER		0.05		500					570 nc	5.7	410	410	120
METHYLENE CHLORIDE	0.003		0.003	1000					200 c	1.1	1100	1100	140
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	2500					4400 nc	1.2	1600	1600	280
MOLYBDENUM*	2.5		2.5	2500	40				550 nc				
NAPHTHALENE	0.05		0.09	2500		40			4400 nc	4.6	1300	1400	120
NICKEL	2.5		43	2500	160				710 nc				
PENTACHLOROPHENOL	0.1		0.1	2500		5			12 c	160	13000	680	1200
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0.69	2500		40	190	Shl/Tex		720		150	
PHENOL	0.1		0.1	1000		40			28000 nc	64	760	390	46000
POLYCHLORINATED BIPHENYLS	0.3		0.3				25	CCME					
PYRENE	0.05		1	2500					1800 nc	500		250	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	2500	10				3100 nc				
SILVER	0.25		0.42	2500	40				240 nc				
STYRENE	0.002		0.002	1000					28 c	1.7	(6.7) 16	840	(0.43) 1.2
TETRACHLOROETHANE, 1,1,1,2-		0.005		500					4.9 c	0.39	0.46	3900	0.019
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000					0.64 c	0.01	0.22	240	0.037
TETRACHLOROETHYLENE	0.002		0.002	1000		60			290 c	0.45	(45) 240	760	(3.8) 22
THALLIUM	2.5		2.5	2500					32 nc				
TOLUENE	0.002		0.002	1000		150			19000 nc	2.1	510	4300	34
TPH - refer to PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		2500		30			1300 nc	110	950	770	87
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500					9900 nc	34	720	8500	26
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500					3.1 c	0.28	(1.7) 920	2900	(0.19) 92
TRICHLOROETHYLENE	0.004		0.004	500		60			140 c	3.9	(2.3) 21	3900	(0.12) 1.1
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500		10			4700 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500		10			59 c	0.66	12000	3200	1100
VANADIUM'	5		91	2500	200				910 nc				
VINYL CHLORIDE	0.003		0.003	500		60			0.50 c	0.38	0.094	100	0.0012
XYLENES	0.002		0.002	1000					190000 nc	25	460	4100	34
ZINC	25		160	2500	600				100000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		1.4								
CHLORIDE***	0.25		330										
NITRATE***	5		61										
NITRITE***	5		61										
SODIUM ADSORPTION RATIO (SAR)			2.4		12								
SODIUM***	25												

c Cancer Risk nc Noncancer Risk

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

' MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Inorganic mercury criteria used. *** Soil criterion not available.

( ) Value in bracket is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA- FOR COARSE TEXTURED SOIL SITUATION

FOR COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
ACENAPHTHENE	1.3	MISA	1700	50000	20	Odour			5200	AWQC
ACENAPHTHYLENE	1.4	MISA	2000	50000	310	Noncancer Risk				
ACETONE	0.01	MASS.	500000000	50000	3000	ORSGL	1800000	Volatility Risk	3300	LOEL
ALDRIN	0.01	DW	8.5	50000	0.002	Cancer Risk	0.2	Volatility Risk	30	AWQC
ANTHRACENE	0.01	DW	650	50000	2100	Noncancer Risk			.12	LOEL
ANTIMONY	0.1	DW		50000	6	ORSGL			16000	AWQC
ARSENIC	0.5	DW		50000	25	ODWO			480	AWQC
BARIUM	0.25	DW		50000	1000	ODWO			23000	LOEL
BENZENE	0.5	DW	890000	50000	5	ODWO	(10) 1900	Air Background	53000	AWQC
BENZO(a)ANTHRACENE	0.2	DW	5	50000	0.2	ORSGL			18	LOEL
BENZO(a)PYRENE	0.05	DW	1.9	50000	0.01	ODWO	590	Volatility Risk	2.1	LOEL
BENZO(b)FLUORANTHENE	0.1	DW	7	50000	0.2	ORSGL				
BENZO(g,h,i)PERYLENE	0.2	DW	0.13	50000	310	Noncancer Risk			2.0	LOEL
BENZO(k)FLUORANTHENE	0.01	DW	0.4	50000	0.2	ORSGL			74	LOEL
BERYLLIUM	0.25	DW		50000	4	ORSGL			53	AWQC
BIPHENYL, 1,1-	0.6	MISA	3800	50000	350	Noncancer Risk			1700	LOEL
BIS(2-CHLOROETHYL)ETHER	4.4	MISA	5100000	50000	0.03	Cancer Risk	110	Volatility Risk	2400000	AWQC
BIS(2-CHLOROISOPROPYL)ETHER	2.2	MISA	850000	50000	0.5	Cancer Risk	430	Volatility Risk	2400000	AWQC
BIS(2-ETHYLHEXYL)PHTHALATE	2.2	MISA	650	50000	8	ORSGL	1300000	Volatility Risk	30	AWQC
BORON	10	DW		50000	5000	ODWO				
BROMODICHLOROMETHANE	0.8	MISA	2300000	50000	5	ORSGL			670000	LOEL
BROMOFORM	5	DW	1600000	50000	5	ORSGL	840	Volatility Risk	290000	LOEL
BROMOMETHANE	3.7	MISA	8800000	50000	10	ORSGL	2	Volatility Risk	3200	LOEL
CADMIUM	0.25	DW		50000	5	ODWO			11	AWQC
CARBON TETRACHLORIDE	2	DW	400000	50000	5	ODWO	(1.4) 17	Air Background	350000	AWQC
CHLORDANE	0.02	DW	28	50000	7	ODWO	28	Volatility Risk	0.04	AWQC
CHLOROANILINE, p-	20	MASS	1300000	50000	28	Noncancer Risk			100	LOEL
CHLOROBENZENE	0.5	DW	240000	50000	30	ODWO	(400) 1200	Air Background	500	AWQC
CHLOROFORM	1	DW	4700000	50000	5	ORSGL	(8) 430	Air Background	12000	AWQC
CHLOROPHENOL, 2-	0.3	DW	14000000	50000	0.18	Odour			44000	AWQC
CHROMIUM (Total)	2.5	DW		50000	50	ODWO			2000	LOEL
CHROMIUM (III)										

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA- FOR COARSE TEXTURED SOIL SITUATION										
FOR COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
CHROMIUM (VI)	10	DW		50000	50	MMCL			110	AWQC
CHRYSENE	0.5	DW	3	50000	0.2	ORSGL			7	LOEL
COBALT	0.1	DW		50000					100	LOEL
COPPER	2.5	DW		50000	1000	ODWO			23	LOEL
CYANIDE	5	DW	500000000	50000	200	ODWO			52	AWQC
DIBENZO(a,h)ANTHRACENE	0.1	DW	0.25	50000	0.2	ORSGL			150	LOEL
DIBROMOCHLOROMETHANE	2	DW	2000000	50000	5	ORSGL			650000	LOEL
DICHLOROBENZENE, 1,2- (o-DCB)	0.5	DW	73000	50000	3	ODWO	10000	Volatility Risk	7600	AWQC
DICHLOROBENZENE, 1,3- (m-DCB)	0.5	DW	62000	50000	630	Noncancer Risk	10000	Volatility Risk	7600	AWQC
DICHLOROBENZENE, 1,4- (p-DCB)	0.5	DW	40000	50000	1	ODWO	29000	Volatility Risk	7600	AWQC
DICHLOROBENZIDINE, 3,3'-	63	MASS.	1600	50000	0.08	Cancer Risk			5000	LOEL
DDD	0.08	MISA	80	50000	30	ODWO			6	AWQC
DDE	0.08	MISA	20	50000	30	ODWO			10000	AWQC
DDT	0.05	DW	1.6	50000	30	ODWO	130	Volatility Risk	0.001	AWQC
DICHLOROETHANE, 1,1-	0.5	DW	2800000	50000	70	ORSGL	9000	Volatility Risk	2000000	LOEL
DICHLOROETHANE, 1,2-	1	DW	4400000	50000	5	ODWO	17	Volatility Risk	200000	AWQC
DICHLOROETHYLENE, 1,1-	0.5	DW	110000	50000	7	MMCL	0.66	Volatility Risk	120000	AWQC
DICHLOROETHYLENE, CIS-1,2-	0.5	DW	400000	50000	70	MMCL			120000	AWQC
DICHLOROETHYLENE, TRANS-1,2-	0.5	DW	300000	50000	100	MMCL			120000	AWQC
DICHLOROPHENOL, 2,4-	0.2	DW	2300000	50000	0.3	ODWO			3700	AWQC
DICHLOROPROPANE, 1,2-	0.5	DW	1400000	50000	5	MMCL	9.3	Volatility Risk	57000	AWQC
DICHLOROPROPENE, 1,3-	1.4	MISA	1400000	50000	0.5	ORSGL	3.8	Volatility Risk	2400	AWQC
DIELDRIN	0.02	DW	93	50000	0.0022	Cancer Risk	1.8	Volatility Risk	0.02	AWQC
DIETHYL PHTHALATE	4	MASS.	450000	50000	5600	Noncancer Risk			30	AWQC
DIMETHYL PHTHALATE	1.5	MASS.	2500000	50000	7000	Noncancer Risk			30	AWQC
DIMETHYLPHENOL, 2,4-	7.3	MISA	3900000	50000	140	Noncancer Risk			21000	AWQC
DINITROPHENOL, 2,4-	42	MISA	2800000	50000	14	Noncancer Risk			1500	AWQC
DINITROTOLUENE, 2,4-	0.5	DW	140000	50000	0.05	Cancer Risk			2300	AWQC
DIOXIN / FURAN (TEQ)	0.000004	DW		50000	0.000015	ODWO				
ENDOSULFAN	0.12	MASS.	75	50000	0.35	Noncancer Risk			0.56	AWQC
ENDRIN	0.05	DW	130	50000	2	MMCL			0.02	AWQC
ETHYLBENZENE	0.5	DW	81000	50000	2.4	ODWO	28000	Volatility Risk	320000	AWQC

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA- FOR COARSE TEXTURED SOIL SITUATION

FOR COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
ETHYLENE DIBROMIDE	**1**	DW	2200000	50000	0.00041	Cancer Risk	3.3	Volatility Risk	28000	LOEL
FLUORANTHENE	0.2	DW	**130**	50000	280	Noncancer Risk			40000	AWQC
FLUORENE	1.7	DW	950	50000	**280**	Noncancer Risk			290	LOEL
HEPTACHLOR	0.01	DW	28	50000	3	ODWO	0.25	Volatility Risk	**0.04**	AWQC
HEPTACHLOR EPOXIDE	0.01	DW	180	50000	**3**	ODWO	6.0	Volatility Risk		
HEXACHLOROBENZENE	0.01	DW	55	50000	1	ORSGL	**0.62**	Volatility Risk	37	AWQC
HEXACHLOROBUTADIENE	0.01	DW	1000	50000	**0.45**	Cancer Risk	0.87	Volatility Risk	93	AWQC
HEXACHLOROCYCLOHEXANE, GAMMA	0.01	DW	3500	50000	4	ODWO			**0.8**	AWQC
HEXACHLOROETHANE	0.01	DW	25000	50000	**2.5**	Cancer Risk	12	Volatility Risk	5400	AWQC
INDENO(1,2,3-cd)PYRENE	**0.2**	DW	0.27	50000	0.0048	Cancer Risk				
LEAD	0.25	DW		50000	**10**	ODWO			32	AWQC
MERCURY	0.02	DW	28	50000	1	ODWO			**0.12**	AWQC
METHOXYCHLOR	0.05	DW	20	50000	900	ODWO			**0.3**	AWQC
METHYL ETHYL KETONE	100	MASS.	140000000	50000	**350**	ORSGL	1700000	Volatility Risk	1200000	LOEL
METHYL ISOBUTYL KETONE	50	MASS.	9600000	50000	**350**	ORSGL	57000	Volatility Risk	4300000	LOEL
METHYL MERCURY				50000	2.1	Noncancer Risk			**0.12**	AWQC
METHYL TERT BUTYL ETHER	0.5	MASS	24000000	50000	**700**	ORSGL	83000	Volatility Risk	1000000	LOEL
METHYLENE CHLORIDE	5	DW	8400000	50000	**50**	ODWO	92000	Volatility Risk	130000	LOEL
METHYLNAPHTHALENE, 2-	2.2	MISA	13000	50000	**10**	Odour	24000	Volatility Risk	15000	AWQC
MOLYBDENUM	0.25	DW		50000					**7300**	LOEL
NAPHTHALENE	1.6	MISA	16000	50000	**21**	Odour	5900	Volatility Risk	6200	AWQC
NICKEL	1	DW		50000	**100**	ORSGL			1600	LOEL
PENTACHLOROPHENOL	0.1	DW	7000	50000	**30**	ODWO	2400	Volatility Risk	130	LOEL
PETROLEUM HYDROCARBONS (gasoline/diesel)					**1000**	Ceiling *				
PETROLEUM HYDROCARBONS (heavy oils)					**1000**	Ceiling *				
PHENANTHRENE	0.1	DW	410	50000	310	Noncancer Risk			**63**	AWQC
PHENOL	2.4	MISA	40000000	50000	**4200**	Noncancer Risk	20000000	Volatility	26000	AWQC
POLYCHLORINATED BIPHENYLS	**0.2**	DW	16	50000	3	ODWO	0.98	Volatility Risk	0.15	AWQC
PYRENE	0.2	DW	80	50000	210	Noncancer Risk			**40**	LOEL
SELENIUM	5	DW		50000	**10**	ODWO			50	AWQC
SILVER	0.25	DW		50000	35	Noncancer Risk			**1.2**	AWQC
STYRENE	0.5	DW	150000	50000	**100**	MMCL	(400) 940	Air Background		

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA- FOR COARSE TEXTURED SOIL SITUATION

FOR COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
TETRACHLOROETHANE, 1,1,1,2-	5	MASS	100000	50000	1.4	Cancer Risk	6	Volatility Risk	93000	AWQC
TETRACHLOROETHANE, 1,1,2,2-	1	DW	1500000	50000	0.18	Cancer Risk	22	Volatility Risk	24000	AWQC
TETRACHLOROETHYLENE	0.5	DW	100000	50000	5	MMCL	(500) 2600	Air Background	8400	AWQC
THALLIUM	0.25	DW		50000	2	ORSGL			400	AWQC
TOLUENE	0.5	DW	270000	50000	24	ODWO	5900	Volatility Risk	180000	AWQC
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-	0.05	DW	9500	50000	70	ORSGL	620	Volatility Risk	500	AWQC
TRICHLOROETHANE, 1,1,1-	0.5	DW	370000	50000	200	MMCL	4200	Volatility Risk	180000	AWQC
TRICHLOROETHANE, 1,1,2-	0.6	DW	2300000	50000	5	ORSGL	(30) 16000	Air Background	94000	AWQC
TRICHLOROETHYLENE	0.5	DW	550000	50000	50	ODWO	(30) 270	Air Background	220000	AWQC
TRICHLOROPHENOL, 2,4,5-	0.6	DW	600000	50000	200	Odour			630	AWQC
TRICHLOROPHENOL 2,4,6-	0.2	DW	400000	50000	2	ODWO	37000	Volatility Risk	9700	AWQC
VANADIUM	0.25	DW		50000					200	LOEL
VINYL CHLORIDE	0.5	DW	550	50000	2	ODWO	0.01	Volatility Risk	3600000	AWQC
XYLENES	1.1	DW	86000	50000	300	ODWO	5600	Volatility Risk		
ZINC	1	DW		50000	5000	ODWO			1100	LOEL
ELECTRICAL CONDUCTIVITY (mS/cm)	0.005	DW								
CHLORIDE	2000	MISA			250000	ODWO				
NITRATE	250	MISA		50000	10000	ODWO				
NITRITE	250	MISA		50000	1000	ODWO			2000	LOEL
SODIUM ADSORPTION RATIO (SAR)										
SODIUM	50	MISA			200000	ODWO				

( ) Volatility risk value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

* Massachusetts set a GW1 ceiling value of 1000 ug/L for TPH.

Appendix A.2.2: Table B Criteria Components - Coarse Textured Soil (Surface/Full Depth) - Non-Potable Groundwater Situation

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/A
ACENAPHTHENE	0.05		0.07	**1000**					1400 nc		1300	
ACENAPHTHYLENE	0.05		0.08	**100**					1000 nc		840	
ACETONE		0.1		500					3400 nc	58	**3.8**	1900
ALDRIN	**0.08**		0.05	1000		0.35			0.026 c	1.6	69	0.15
ANTHRACENE	0.05		0.16	1000		40			5300 nc		**28**	
ANTIMONY	1		1	1000	20				**13 nc**			
ARSENIC	1		17	1000	**20**							
BARIUM'	2.5		210	1000	**750**				3700 nc			
BENZENE	0.002		0.002	500		25			35 c	(0.48) 89	2400	(0.031) **5.3**
BENZO(a)ANTHRACENE	0.05		0.74	1000		**40**	120	Shl/Tex			170	
BENZO(a)PYRENE	0.05		0.49	1000		40	**1.2**	Shl/Tex		1700	1700	49000
BENZO(b)FLUORANTHENE	0.05		0.47	1000			**12**	Shl/Tex			640	
BENZO(g,h,i)PERYLENE	0.1		0.68	1000		**40**	120	Shl/Tex			53	
BENZO(k)FLUORANTHENE	0.05		0.48	1000		40	**12**	Shl/Tex			37	
BERYLLIUM	0.5		**1.2**	1000	4				0.37 c			
BIPHENYL, 1,1-		0.05		1000					1900 nc		**4.3**	
BIS(2-CHLOROETHYL)ETHER		**0.66**		500					0.12 c	0.25	110	0.13
BIS(2-CHLOROISOPROPYL)ETHER		0.66		500					1.9 c	4.7	540	**0.82**
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					**130 c**	11000	500	1000000
BORON (Available)'					**1.5**							
BROMODICHLOROMETHANE		0.005		100					**14 c**		1200	
BROMOFORM	0.002		0.002	500					110 c	19	1100	**2.3**
BROMOMETHANE	0.003		0.003	500					47 nc	4.5	3900	**0.061**
CADMIUM	1		1	1000		**12**			14 nc			
CARBON TETRACHLORIDE	0.002		0.002	500					6.8 c	(0.28) 3.3	10000	(0.0068) **0.1**
CHLORDANE	0.05		0.05	1000					0.99 c	200	**0.29**	18
CHLOROANILINE, p-		**1.3**		100					130 nc		1.1	
CHLOROBENZENE	0.002		0.002	500		30			670 nc	(32) 99	40	(3.2) **8.0**
CHLOROFORM	0.002		0.006	500					140 c	(0.21) 11	330	(0.011) **0.79**
CHLOROPHENOL, 2-	0.1		0.1	1000		**10**			95 nc		800	
CHROMIUM (Total)	5		71	1000	**750**							

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc			
CHROMIUM (VI)	2.5		2.5	1000	8				180 nc			
CHRYSENE	0.05		0.69	1000		40	12	Shl/Tex			100	
COBALT'	2.5		21	1000	40				2700 nc			
COPPER'	5		85	1000	225				1100 nc			
CYANIDE (Free)	0.05		0.12	100					100 nc		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	1000			1.2	Shl/Tex			140	
DIBROMOCHLOROMETHANE	0.003		0.003	100					10 c		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	3000	2300	270
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	100		30			3000 nc		2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	500		30			37 c	9200	2400	830
DICHLOROBENZIDINE, 3,3'-		1.3		1000					0.51 c		400	
DDD	0.05			1000					2.2 c		780	
DDE	0.01			1000		4			1.6 c		15000	
DDT	0.05		1.4	1000		4			1.6 c	62	2.0	470
DICHLOROETHANE, 1,1-	0.002		0.002	100					2600 nc	390	2200	22
DICHLOROETHANE, 1,2-	0.002		0.002	500		60			9.6 c	0.16	460	0.022
DICHLOROETHYLENE, 1,1-	0.002		0.002	500					1.4 c	0.07	5200	0.0024
DICHLOROETHYLENE, CIS-1,2-		0.005		100			2.3	Table A'	340 nc		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	500			4.1	Table A'	670 nc		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	100		10			41 nc		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	100					7.9 c	0.23	1300	0.019
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	0.1	63	0.0066
DIELDRIN	0.05		0.05	1000		4			0.028 c	2.2	0.025	0.21
DIETHYL PHTHALATE		0.66		1000					44000 nc		0.71	
DIMETHYL PHTHALATE		0.66		1000					39000 nc		0.7	
DIMETHYLPHENOL, 2,4-	0.2		0.2	1000					380 nc		140	
DINITROPHENOL, 2,4-	0.2		0.2	1000					38 nc		4.1	
DINITROTOLUENE, 2,4-		0.66		1000					1.1 c		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				1	CCME				
ENDOSULFAN	0.04	0.009		1000					140 nc		0.29	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc		0.014	
ETHYLBENZENE	0.002		0.002	500					2300 nc	3300	5800	290
ETHYLENE DIBROMIDE	0.004		0.004	100					0.01 c	0.038	320	0.0056
FLUORANTHENE	0.05		1.1	1000		40			910 nc		840	
FLUORENE	0.05		0.12	1000					910 nc		350	
HEPTACHLOR	0.05		0.05	1000					0.12 c	0.91	0.15	0.084
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	23	680	2.1
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	130	7300	11
HEXACHLOROBUTADIENE	0.01			100					6.9 c	4.3	460	0.38
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c		0.49	
HEXACHLOROETHANE	0.01			100					6.3 nc	42	18000	3.8
INDENO(1,2,3-cd)PYRENE	0.1		0.38	1000		40	12	Sh/Tex			70	
LEAD	10		120	1000			200	MOEE 1				
MERCURY	0.05		0.23	1000		10			13 nc			
METHOXYCHLOR	0.05		0.05	1000					110 nc		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	38	38	1700
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	69	69	58
METHYL MERCURY				1000		10			6.8 nc			
METHYL TERT BUTYL ETHER		0.05		100					170 nc	410	410	120
METHYLENE CHLORIDE	0.003		0.003	500					120 nc	1100	1100	140
METHYLNAPHTHALENE, 2- (1-)	0.05		0.29	1000					1300 nc	1600	1600	280
MOLYBDENUM'	2.5		2.5	1000	40				170 nc			
NAPHTHALENE	0.05		0.09	100		40			1300 nc	1300	1400	120
NICKEL	2.5		43	1000	150				310 nc			
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.9 c	13000	680	1200
PETROLEUM HYDROCARBONS (gasoline/diesel)							1000	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2				
PHENANTHRENE	0.05		0.69	1000		40	120	Sh/Tex			150	
PHENOL	0.1		0.1	500		40			11000 nc	760	390	46000
POLYCHLORINATED BIPHENYLS	0.3		0.3				5	CCME				
PYRENE	0.05		1	1000					680 nc		250	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	1000	10				320 nc			
SILVER	0.25		0.42	1000	20				98 nc			
STYRENE	0.002		0.002	500					18 c	(6.7) 16	840	(0.43) 1.2
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	0.46	3900	0.019
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	0.22	240	0.037
TETRACHLOROETHYLENE	0.002		0.002	500		60	0.45	Table A*	170 c	(45) 240	760	(3.8) 22
THALLIUM	2.5		2.5	1000					4.1 nc			
TOLUENE	0.002		0.002	500		150			6100 nc	510	4300	34
TPH - refer to PETROLEUM HYDROCARBONS												
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	950	770	87
TRICHLOROETHANE, 1,1,1-	0.002		0.009	100			26	Table A*	3000 nc	720	8500	26
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	(1.7) 920	2900	(0.19) 92
TRICHLOROETHYLENE	0.004		0.004	100		60	1.1	Table A*	67 nc	(2.3) 21	3900	(0.12) 1.1
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	12000	3200	1100
VANADIUM+	5		91	1000	200				470 nc			
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.094	100	0.0012
XYLENES	0.002		0.002	500					61000 nc	460	4100	34
ZINC	25		160	1000	600				16000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		0.7							
CHLORIDE**	0.25		330									
NITRATE**	5		61									
NITRITE**	5		61									
SODIUM ADSORPTION RATIO (SAR)			2.4		5							
SODIUM**	25											

c Cancer Risk nc Noncancer Risk

+ S-1 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

( ) Value in bracket is based on meeting indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

('1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

** Soil criterion not available.

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	2500					3600 nc		1300	
ACENAPHTHYLENE	0.05		0.08	2500					2700 nc		840	
ACETONE		0.1		1000					11000 nc	58	3.8	1900
ALDRIN	0.05		0 05	2500		0.35			0.04 c	1.6	69	0.15
ANTHRACENE	0.05		0.16	2500		40			13000 nc		28	
ANTIMONY	1		1	2500	40				44 nc			
ARSENIC	1		17	2500	40							
BARIUM*	2.5		210	2500	1500				8700 nc			
BENZENE	0.002		0.002	1000		25			63 c	(0.48) 89	2400	(0.031) 5.3
BENZO(a)ANTHRACENE	0.05		0.74	2500		40	190	Shl/Tex			170	
BENZO(a)PYRENE	0.05		0.49	2500		40	1.9	Shl/Tex		1700	1700	49000
BENZO(b)FLUORANTHENE	0.05		0.47	2500			19	Shl/Tex			640	
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		40	190	Shl/Tex			53	
BENZO(k)FLUORANTHENE	0.05		0.48	2500		40	19	Shl/Tex			37	
BERYLLIUM	0.5		1.2	2500	11				0.85 c			
BIPHENYL, 1,1-		0.05		2500					6600 nc		4.3	
BIS(2-CHLOROETHYL)ETHER		0.66		1000					0.16 c	0.25	110	0.13
BIS(2-CHLOROISOPROPYL)ETHER		0 66		1000					2.6 c	4.7	540	0.82
BIS(2-ETHYLHEXYL)PHTHALATE		0 66		2500					330 c	11000	500	1000000
BORON (Available)*					2							
BROMODICHLOROMETHANE		0.005		500					25 c		1200	
BROMOFORM	0 002		0.002	1000					190 c	19	1100	2.3
BROMOMETHANE	0 003		0.003	1000					150 nc	4.5	3900	0.061
CADMIUM	1		1	2500		12			41 nc			
CARBON TETRACHLORIDE	0 002		0.002	1000					12 c	(0.28) 3 3	10000	(0.0068) 0.1
CHLORDANE	0.05		0.05	2500					2.0 c	200	0.29	18
CHLOROANILINE, p-		1.3		2500					440 nc		1.1	
CHLOROBENZENE	0 002		0.002	1000		30			2200 nc	(32) 99	40	(3.2) 8.0
CHLOROFORM	0.002		0.006	1000					250 c	(0.21) 11	330	(0.011) 0.79
CHLOROPHENOL, 2-	0.1		0.1	2500		10			240 nc		800	
CHROMIUM (Total)	5		71	2500	750							

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS													
COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		2500		230			22000 nc			
CHROMIUM (VI)	2.5		2.5	2500	**8**				600 nc			
CHRYSENE	0.05		0.69	2500		40	**19**	Shl/Tex			100	
COBALT'	2.5		21	2500	**80**				7200 nc			
COPPER'	5		85	2500	**225**				3400 nc			
CYANIDE (Free)	0.05		0.12	500					**100 nc**		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500			**1.9**	Shl/Tex			140	
DIBROMOCHLOROMETHANE	0.003		0.003	500					**18 c**		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500		**30**			9900 nc	3000	2300	270
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500		**30**			9900 nc		2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000		**30**			63 c	9200	2400	830
DICHLOROBENZIDINE, 3,3'-		**1.3**		2500					0.72 c		400	
DDD	0.05			2500					**3.5 c**		780	
DDE	0.01			2500		4			**2.4 c**		15000	
DDT	0.05		1.4	2500		4			2.4 c	62	**2.0**	470
DICHLOROETHANE, 1,1-	0.002		0.002	500					8500 nc	390	2200	**22**
DICHLOROETHANE, 1,2-	0.002		0.002	1000		60			17 c	0.16	460	**0.022**
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000					2.5 c	0.07	5200	**0.0024**
DICHLOROETHYLENE, CIS-1,2-		0.005		500			**2.3**	Tbl A	1100 nc		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000			**4.1**	Tbl A	2200 nc		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	2500		**10**			94 nc		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	500					12 c	0.23	1300	**0.019**
DICHLOROPROPENE, 1,3-	0.003		0.003	1000					4.6 c	0.10	63	**0.0066**
DIELDRIN	**0.05**		0.05	2500		4			0.04 c	2.2	0.025	0.21
DIETHYL PHTHALATE		0.66		2500					270000 nc		**0.71**	
DIMETHYL PHTHALATE		0.66		2500					150000 nc		**0.7**	
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500					940 nc		**140**	
DINITROPHENOL, 2,4-	0.2		0.2	2500					94 nc		**4.1**	
DINITROTOLUENE, 2,4-		0.66		2500					**1.8 c**		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				**1**	CCME				
ENDOSULFAN	0.04			2500					360 nc		**0.29**	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	2500		0.06			15 nc		0.014	
ETHYLBENZENE	0.002		0.002	1000					6000 nc	3300	5800	290
ETHYLENE DIBROMIDE	0.004		0.004	500					0.02 c	0.038	320	0.0056
FLUORANTHENE	0.05		1.1	2500		40			2400 nc		840	
FLUORENE	0.05		0.12	2500					2400 nc		350	
HEPTACHLOR	0.05		0.05	2500					0.18 c	0.91	0 15	0.084
HEPTACHLOR EPOXIDE	0.05		0.05	2500					0.09 c	23	680	2.1
HEXACHLOROBENZENE	0.01			2500		30			0.76 c	130	7300	11
HEXACHLOROBUTADIENE	0.01			2500					11 c	4.3	460	0.38
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500		2			0.64 c		0.49	
HEXACHLOROETHANE	0.01			2500					13 c	42	1800	3.8
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		40	19	Shl/Tex			70	
LEAD	10		120	2500			1000	MOEE 1				
MERCURY	0 05		0.23	2500		10			57 nc			
METHOXYCHLOR	0 05		0 05	2500					300 nc		4.0	
METHYL ETHYL KETONE		0.1		1000					66000 nc	38	38	1700
METHYL ISOBUTYL KETONE		0.05		500					5500 nc	69	69	58
METHYL MERCURY **				2500		10			18 nc			
METHYL TERT BUTYL ETHER		0.05		500					570 nc	410	410	120
METHYLENE CHLORIDE	0 003		0.003	1000					200 c	1100	1100	140
METHYLNAPHTHALENE, 2- (*1-)	0.05		0 29	2500					4400 nc	1600	1600	280
MOLYBDENUM*	2 5		2 5	2500	40				550 nc			
NAPHTHALENE	0.05		0 09	2500		40			4400 nc	1300	1400	120
NICKEL	2.5		43	2500	150				710 nc			
PENTACHLOROPHENOL	0 1		0 1	2500		5			12 c	13000	680	1200
PETROLEUM HYDROCARBONS (gasoline/diesel)							1000	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)							5000	MOEE 2				
PHENANTHRENE	0 05		0 69	2500		40	190	Shl/Tex			150	
PHENOL	0.1		0.1	1000		40			28000 nc	760	390	46000
POLYCHLORINATED BIPHENYLS	0 3		0.3				25	CCME				
PYRENE	0.05		1	2500					1800 nc		250	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	2500	10				3100 nc			
SILVER	0.25		0.42	2500	40				240 nc			
STYRENE	0.002		0.002	1000					28 c	(6.7) 16	840	(0.43) 1.2
TETRACHLOROETHANE, 1,1,1,2-		0.005		500					4.9 c	0.46	3900	0.019
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000					0.64 c	0.22	240	0.037
TETRACHLOROETHYLENE	0.002		0.002	1000		60	0.45	Tbl A	290 c	(45) 240	760	(3.8) 22
THALLIUM	2.5		2.5	2500					32 nc			
TOLUENE	0.002		0.002	1000		150			19000 nc	510	4300	34
TPH - refer to PETROLEUM HYDROCARBONS												
TRICHLOROBENZENE, 1,2,4-		0.66		2500		30			1300 nc	950	770	87
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500			26	Tbl A	9900 nc	720	8500	26
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500					3.1 c	(1.7) 920	2900	(0.19) 92
TRICHLOROETHYLENE	0.004		0.004	500		60	1.1	Tbl A	140 c	(2.3) 21	3900	(0.12) 1.1
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500		10			4700 nc		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500		10			59 c	12000	3200	1100
VANADIUM'	5		91	2500	200				910 nc			
VINYL CHLORIDE	0.003		0.003	500		60			0.50 c	0.094	100	0.0012
XYLENES	0.002		0.002	1000					190000 nc	460	4100	34
ZINC	25		160	2500	600				100000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		1.4							
CHLORIDE***	0.25		330									
NITRATE***	5		61									
NITRITE***	5		61									
SODIUM ADSORPTION RATIO (SAR)			2.4		12							
SODIUM***	25											

c Cancer Risk nc Noncancer Risk

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Inorganic mercury criteria used. *** Soil criterion not available.

( ) Value in brackets is based on meeting indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR COARSE TEXTURED SOIL SITUATION

COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial)									
CHEMICAL PARAMETER	MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
ACENAPHTHENE	1.3	MISA	1700	50000			5200	AWQC		
ACENAPHTHYLENE	1.4	MISA	2000	50000						
ACETONE	0.01	MASS.	500000000	50000	1800000	Volatility Risk	3300	LOEL		
ALDRIN	0.01	DW	8.5	50000	0.2	Volatility Risk	30	AWQC		
ANTHRACENE	0.01	DW	650	50000			12	LOEL		
ANTIMONY	0.1	DW		50000			16000	AWQC		
ARSENIC	0.5	DW		50000			480	AWQC		
BARIUM	0.25	DW		50000			23000	LOEL		
BENZENE	0.5	DW	890000	50000	(10) 1900	Air Background	53000	AWQC		
BENZO(a)ANTHRACENE	0.2	DW	5	50000			18	LOEL		
BENZO(a)PYRENE	0.05	DW	1.9	50000	590	Volatility Risk	2.1	LOEL		
BENZO(b)FLUORANTHENE	0.1	DW	7	50000						
BENZO(g,h,i)PERYLENE	0.2	DW	0.13	50000			2.0	LOEL		
BENZO(k)FLUORANTHENE	0.01	DW	0.4	50000			74	LOEL		
BERYLLIUM	0.25	DW		50000			53	AWQC		
BIPHENYL, 1,1-	0.6	MISA	3800	50000			1700	LOEL		
BIS(2-CHLOROETHYL)ETHER	4.4	MISA	5100000	50000	110	Volatility Risk	2400000	AWQC		
BIS(2-CHLOROISOPROPYL)ETHER	2.2	MISA	850000	50000	430	Volatility Risk	2400000	AWQC		
BIS(2-ETHYLHEXYL)PHTHALATE	2.2	MISA	650	50000	1300000	Volatility Risk	30	AWQC		
BORON	10	DW		50000						
BROMODICHLOROMETHANE	0.8	MISA	2300000	50000			670000	LOEL		
BROMOFORM	5	DW	1600000	50000	840	Volatility Risk	290000	LOEL		
BROMOMETHANE	3.7	MISA	8800000	50000	2	Volatility Risk	3200	LOEL		
CADMIUM	0.25	DW		50000			11	AWQC		
CARBON TETRACHLORIDE	2	DW	400000	50000	(1.4) 17	Air Background	350000	AWQC		
CHLORDANE	0.02	DW	28	50000	28	Volatility Risk	0.04	AWQC		
CHLOROANILINE, p-	20	MASS.	1300000	50000			100	LOEL		
CHLOROBENZENE	0.5	DW	240000	50000	(400) 1200	Air Background	500	AWQC		
CHLOROFORM	1	DW	4700000	50000	(8) 430	Air Background	12000	AWQC		
CHLOROPHENOL, 2-	0.3	DW	14000000	50000			44000	AWQC		
CHROMIUM (Total)	2.5	DW		50000			2000	LOEL		
CHROMIUM (III)										

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR COARSE TEXTURED SOIL SITUATION

COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial)									
CHEMICAL PARAMETER	MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
CHROMIUM (VI)	10	DW		50000			110	AWQC		
CHRYSENE	0.5	DW	3	50000			7	LOEL		
COBALT	0.1	DW		50000			100	LOEL		
COPPER	2.5	DW		50000			23	LOEL		
CYANIDE	5	DW	500000000	50000			52	AWQC		
DIBENZO(a,h)ANTHRACENE	0.1	DW	0.25	50000			150	LOEL		
DIBROMOCHLOROMETHANE	2	DW	2000000	50000			650000	LOEL		
DICHLOROBENZENE, 1,2- (o-DCB)	0.5	DW	73000	50000	10000	Volatility Risk	7600	AWQC		
DICHLOROBENZENE, 1,3- (m-DCB)	0.5	DW	62000	50000	10000	Volatility Risk	7600	AWQC		
DICHLOROBENZENE, 1,4- (p-DCB)	0.5	DW	40000	50000	29000	Volatility Risk	7600	AWQC		
DICHLOROBENZIDINE, 3,3'-	83	MASS.	1600	50000			5000	LOEL		
DDD	0.08	MISA	80	50000			6	AWQC		
DDE	0.08	MISA	20	50000			10000	AWQC		
DDT	0.05	DW	1.6	50000	130	Volatility Risk	0.001	AWQC		
DICHLOROETHANE, 1,1-	0.5	DW	2800000	50000	9000	Volatility Risk	2000000	LOEL		
DICHLOROETHANE, 1,2-	1	DW	4400000	50000	17	Volatility Risk	200000	AWQC		
DICHLOROETHYLENE, 1,1-	0.5	DW	110000	50000	0.66	Volatility Risk	120000	AWQC		
DICHLOROETHYLENE, CIS-1,2-	0.5	DW	400000	50000			120000	AWQC	70	MMCL
DICHLOROETHYLENE, TRANS-1,2-	0.5	DW	300000	50000			120000	AWQC	100	MMCL
DICHLOROPHENOL, 2,4-	0.2	DW	2300000	50000			3700	AWQC		
DICHLOROPROPANE, 1,2-	0.5	DW	1400000	50000	9.3	Volatility Risk	57000	AWQC		
DICHLOROPROPENE, 1,3-	1.4	MISA	1400000	50000	3.8	Volatility Risk	2400	AWQC		
DIELDRIN	0.02	DW	93	50000	1.8	Volatility Risk	0.02	AWQC		
DIETHYL PHTHALATE	4	MASS.	450000	50000			30	AWQC		
DIMETHYL PHTHALATE	1.5	MASS.	2500000	50000			30	AWQC		
DIMETHYLPHENOL, 2,4-	7.3	MISA	3900000	50000			21000	AWQC		
DINITROPHENOL, 2,4-	42	MISA	2800000	50000			1500	AWQC		
DINITROTOLUENE, 2,4-	0.5	DW	140000	50000			2300	AWQC		
DIOXIN / FURAN (TEQ)	0.000004	DW		50000			0.000015	ODWO **		
ENDOSULFAN	0.12	MASS.	75	50000			0.56	AWQC		
ENDRIN	0.05	DW	130	50000			0.02	AWQC		
ETHYLBENZENE	0.5	DW	81000	50000	28000	Volatility Risk	320000	AWQC		

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR COARSE TEXTURED SOIL SITUATION

COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial)									
CHEMICAL PARAMETER	MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
ETHYLENE DIBROMIDE	1	DW	2200000	50000	3.3	Volatility Risk	28000	LOEL		
FLUORANTHENE	0.2	DW	130	50000			40000	AWQC		
FLUORENE	1.7	DW	950	50000			290	LOEL		
HEPTACHLOR	0.01	DW	28	50000	0.25	Volatility Risk	0.04	AWQC		
HEPTACHLOR EPOXIDE	0.01	DW	180	50000	6.0	Volatility Risk				
HEXACHLOROBENZENE	0.01	DW	55	50000	0.62	Volatility Risk	37	AWQC		
HEXACHLOROBUTADIENE	0.01	DW	1000	50000	0.87	Volatility Risk	93	AWQC		
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	0.5	MASS.	3500	50000			0.8	AWQC		
HEXACHLOROETHANE	0.01	DW	25000	50000	12	Volatility Risk	5400	AWQC		
INDENO(1,2,3-cd)PYRENE	0.2	DW	0.27	50000						
LEAD	0.25	DW		50000			32	AWQC		
MERCURY	0.02	DW	28	50000			0.12	AWQC		
METHOXYCHLOR	0.05	DW	20	50000			0.3	AWQC		
METHYL ETHYL KETONE	100	MASS.	140000000	50000	1700000	Volatility Risk	1200000	LOEL		
METHYL ISOBUTYL KETONE	50	MASS.	9600000	50000	57000	Volatility Risk	4300000	LOEL		
METHYL MERCURY				50000			0.12	AWQC		
METHYL TERT BUTYL ETHER	0.5	MASS	24000000	50000	83000	Volatility Risk	1000000	LOEL		
METHYLENE CHLORIDE	5	DW	8400000	50000	92000	Volatility Risk	130000	LOEL		
METHYLNAPHTHALENE, 2-	2.2	MISA	13000	50000	24000	Volatility Risk	15000	AWQC		
MOLYBDENUM	0.25	DW		50000			7300	LOEL		
NAPHTHALENE	1.6	MISA	16000	50000	5900	Volatility Risk	6200	AWQC		
NICKEL	1	DW		50000			1600	LOEL		
PENTACHLOROPHENOL	0.1	DW	7000	50000	2400	Volatility Risk	130	LOEL		
PETROLEUM HYDROCARBONS (gasoline/diesel)										
PETROLEUM HYDROCARBONS (heavy oils)										
PHENANTHRENE	0.1	DW	410	50000			63	AWQC		
PHENOL	2.4	MISA	40000000	50000	20000000	Volatility Risk	26000	AWQC		
POLYCHLORINATED BIPHENYLS	0.2	DW	16	50000	0.98	Volatility Risk	0.15	AWQC		
PYRENE	0.2	DW	80	50000			40	LOEL		
SELENIUM	5	DW		50000			50	AWQC		
SILVER	0.25	DW		50000			1.2	AWQC		
STYRENE	0.5	DW	150000	50000	(400) 940	Air Background				

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR COARSE TEXTURED SOIL SITUATION

COARSE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial)									
CHEMICAL PARAMETER	MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
TETRACHLOROETHANE, 1,1,1,2-	5	MASS	100000	50000	6	Volatility Risk	93000	AWQC		
TETRACHLOROETHANE, 1,1,2,2-	1	DW	1500000	50000	22	Volatility Risk	24000	AWQC		
TETRACHLOROETHYLENE	0.5	DW	100000	50000	(500) 2600	Air Background	8400	AWQC	5	MMCL
THALLIUM	0.25	DW		50000			400	AWQC		
TOLUENE	0.5	DW	270000	50000	5900	Volatility Risk	180000	AWQC		
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-	0.05	DW	9500	50000	620	Volatility Risk	500	AWQC		
TRICHLOROETHANE, 1,1,1-	0.5	DW	370000	50000	4200	Volatility Risk	180000	AWQC	200	MMCL
TRICHLOROETHANE, 1,1,2-	0.6	DW	2300000	50000	(30) 16000	Air Background	94000	AWQC		
TRICHLOROETHYLENE	0.5	DW	550000	50000	(30) 270	Air Background	220000	AWQC	50	ODWO
TRICHLOROPHENOL, 2,4,5-	0.6	DW	600000	50000			630	AWQC		
TRICHLOROPHENOL 2,4,6-	0.2	DW	400000	50000	37000	Volatility Risk	9700	AWQC		
VANADIUM	0.25	DW		50000			200	LOEL		
VINYL CHLORIDE	0.5	DW	550	50000	0.01	Volatility Risk	3600000	AWQC		
XYLENES	1.1	DW	86000	50000	5600	Volatility Risk				
ZINC	1	DW		50000			1100	LOEL		
ELECTRICAL CONDUCTIVITY (mS/cm)	0.005	DW								
CHLORIDE	2000	MISA								
NITRATE	250	MISA		50000						
NITRITE	250	MISA		50000			2000	LOEL		
SODIUM ADSORPTION RATIO (SAR)										
SODIUM	50	MISA								

( ) Volatility risk value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

* Groundwater criterion from Table A (potable groundwater) adopted to account for degradation to vinyl chloride.

** ODWO used due to unavailability of a LOEL for total Dioxins/Furans (TEQ)

Appendix A.2.3: Table C Criteria Components - Coarse Textured Soil (Sub-surface) - Potable Groundwater Situation

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	2500				3600 nc	15		1300
ACENAPHTHYLENE	0.05		0.08	2500				2700 nc	130		840
ACETONE		0.1		1000				11000 nc	3.5	58	3.8
ALDRIN	0.05		0.05	2500				0.04 c	0.08	1.6	69
ANTHRACENE	0.05		0.16	2500				13000 nc	1500		28
ANTIMONY	1		1	2500				44 nc			
ARSENIC	1		17	2500	40						
BARIUM'	2.5		210	2500				8700 nc			
BENZENE	0.002		0.002	1000				63 c	0.24	(0.48) 89	2400
BENZO(a)ANTHRACENE	0.05		0.74	2500		190	Shl/Tex		6.6		170
BENZO(a)PYRENE	0.05		0.49	2500		1.9	Shl/Tex		9.0	1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	2500		19	Shl/Tex		18		640
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		190	Shl/Tex		53		53
BENZO(k)FLUORANTHENE	0.05		0.48	2500		19	Shl/Tex		18		37
BERYLLIUM	0.5		1.2	2500				0.85 c			
BIPHENYL, 1,1-		0.05		2500				6600 nc	0.89		4.3
BIS(2-CHLOROETHYL)ETHER		0.66		1000				0.16 c	0.01	0.25	110
BIS(2-CHLOROISOPROPYL)ETHER		0.66		1000				2.6 c	0.02	4.7	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500				330 c	100	11000	500
BORON (Available)'					2						
BROMODICHLOROMETHANE		0.005		500				25 c	0.12		1200
BROMOFORM	0.002		0.002	1000				190 c	0.11	19	1100
BROMOMETHANE	0.003		0.003	1000				150 nc	12	4.5	3900
CADMIUM	1		1	2500				41 nc			
CARBON TETRACHLORIDE	0.002		0.002	1000				12 c	1.0	(0.28) 3.3	10000
CHLORDANE	0.05		0.05	2500				2.0 c	5.1	200	0.29
CHLOROANILINE, p-		1.3		2500				440 nc	0.3		1.1
CHLOROBENZENE	0.002		0.002	1000				2200 nc	2.4	(32) 99	40
CHLOROFORM	0.002		0.006	1000				250 c	0.13	(0.21) 11	330
CHLOROPHENOL, 2-	0.1		0.1	2500				240 nc	0.0055		800
CHROMIUM (Total)	5		71	2500							

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		2500				220000 nc			
CHROMIUM (VI)	2.5		2.5	2500				600 nc			
CHRYSENE	0.05		0.69	2500		19	Shl/Tex		17		100
COBALT*	2.5		21	2500				7200 nc			
COPPER*	5		85	2500				3400 nc			
CYANIDE (Free)	0.05		0.12	500				100. nc	1000000		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500		1.9	Shl/Tex		110		140
DIBROMOCHLOROMETHANE	0.003		0.003	500				18 c	0.09		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500				9900 nc	0.88	3000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500				9900 nc	190		2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000				63 c	0.32	9200	2400
DICHLOROBENZIDINE, 3,3'-		1.3		2500				0.72 c	21		400
DDD	0.05			2500				3.5 c	3900		780
DDE	0.01			2500				2.4 c	22000		15000
DDT	0.05		1.4	2500				2.4 c	1200	62	2.0
DICHLOROETHANE, 1,1-	0.002		0.002	500				8500 nc	3.0	390	2200
DICHLOROETHANE, 1,2-	0.002		0.002	1000				17 c	0.05	0.16	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000				2.5 c	0.72	0.07	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500				1100 nc	2.3		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000				2200 nc	4.1		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	2500				94 nc	0.3		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	500				12 c	0.13	0.23	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	1000				4.6 c	0.04	0.10	63
DIELDRIN	0.05		0.05	2500				0.04 c	0.025	2.2	0.025
DIETHYL PHTHALATE		0.66		2500				27000 nc	130		0.71
DIMETHYL PHTHALATE		0.66		2500				15000 nc	1200		0.7
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500				940 nc	0.94		140
DINITROPHENOL, 2,4-	0.2		0.2	2500				94 nc	0.12		4.1
DINITROTOLUENE, 2,4-		0.66		2500				1.8 c	0.004		17
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007			1	CCME				
ENDOSULFAN	0.04			2500				360 nc	0.18		0.29

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	2500				15 nc	0.56		0.014
ETHYLBENZENE	0.002		0.002	1000				6000 nc	0.28	3300	5800
ETHYLENE DIBROMIDE	0.004		0.004	500				0.02 c	0.012	0.038	320
FLUORANTHENE	0.05		1.1	2500				2400 nc	840		840
FLUORENE	0.05		0.12	2500				2400 nc	340		350
HEPTACHLOR	0.05		0.05	2500				0.18 c	11	0.91	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	2500				0.09 c	12	23	680
HEXACHLOROBENZENE	0.01			2500				0.76 c	200	130	7300
HEXACHLOROBUTADIENE	0.01			2500				11 c	2.2	4.3	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500				0.64 c	2.5		0.49
HEXACHLOROETHANE	0.01			2500				13 c	6.5	42	18000
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		19	Sh/Tex		53		70
LEAD	10		120	2500		1000	MOEE 1				
MERCURY	0.05		0.23	2500				57 nc			
METHOXYCHLOR	0.05		0.05	2500				300 nc	12000		4.0
METHYL ETHYL KETONE		0.1		1000				66000 nc	0.27	38	38
METHYL ISOBUTYL KETONE		0.05		500				5500 nc	0.48	69	69
METHYL MERCURY				2500				18 nc			
METHYL TERT BUTYL ETHER		0.05		500				570 nc	5.7	410	410
METHYLENE CHLORIDE	0.003		0.003	1000				200 c	1.1	1100	1100
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	2500				4400 nc	1.2	1600	1600
MOLYBDENUM'	2.5		2.5	2500				550 nc			
NAPHTHALENE	0.05		0.09	2500				4400 nc	4.6	1300	1400
NICKEL	2.5		43	2500				710 nc			
PENTACHLOROPHENOL	0.1		0.1	2500				12 c	160	13000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)						100	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)						1000	MOEE 2				
PHENANTHRENE	0.05		0.69	2500		190	Sh/Tex		720		150
PHENOL	0.1		0.1	1000				28000 nc	64	760	390
POLYCHLORINATED BIPHENYLS	0.3		0.3			25	CCME				
PYRENE	0.05		1	2500				1800 nc	500		250

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
SELENIUM	1		1.9	**2500**				3100 nc			
SILVER	0.25		0.42	2500				**240 nc**			
STYRENE	0.002		0.002	1000				28 c	**1.7**	(6.7) 16	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500				4.9 c	**0.39**	0.46	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000				0.64 c	**0.01**	0.22	240
TETRACHLOROETHYLENE	0.002		0.002	1000				290 c	**0.45**	(45) 240	760
THALLIUM	2.5		2.5	2500				**32 nc**			
TOLUENE	0.002		0.002	1000				19000 nc	**2.1**	510	4300
TPH - refer to PETROLEUM HYDROCARBONS											
TRICHLOROBENZENE, 1,2,4-		0.66		2500				1300 nc	**110**	950	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500				9900 nc	**34**	720	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500				3.1 c	**0.28**	(1.7) 920	2900
TRICHLOROETHYLENE	0.004		0.004	500				140 c	**3.9**	(2.3) 21	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500				4700 nc	**3.2**		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500				59 c	**0.66**	12000	3200
VANADIUM'	5		91	2500				**910 nc**			
VINYL CHLORIDE	0.003		0.003	500				0.50 c	0.38	**0.094**	100
XYLENES	0.002		0.002	1000				190000 nc	**25**	460	4100
ZINC	25		160	**2500**				100000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57								
CHLORIDE ^	0.25		330								
NITRATE ^	5		61								
NITRITE ^	5		61								
SODIUM ADSORPTION RATIO (SAR) ***			2.4								
SODIUM ^	25										

c Cancer Risk nc Noncancer Risk ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

' MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

'' Mass. direct soil contact risk value for Cr (III) was utilized for the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr(III), whereas Cr (VI) normally contributes very little to the total.

('1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion not applicable. ^ Soil Criterion not available.

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil ContacT	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	5000			17000 nc	**15**		1300
ACENAPHTHYLENE	0.05		0.08	5000			[2700] 1200 nc	**130**		840
ACETONE		0.1		2500			52000 nc	**3.5**	58	3.8
ALDRIN	0.05		0.05	5000			0.15 c	**0.08**	1.6	69
ANTHRACENE	0.05		0.16	5000			60000 nc	1500		**28**
ANTIMONY	1		1	5000			**[44] .21 nc**			
ARSENIC *	1		17	5000						
BARIUM*	2.5		210	[2500] 5000			**[8700] 4100 nc**			
BENZENE	0.002		0.002	2500			230 c	**0.24**	(0.48) 89	2400
BENZO(a)ANTHRACENE	0.05		0.74	5000	720	Shl/Tex		**6.6**		170
BENZO(a)PYRENE	0.05		0.49	5000	**7.2**	Shl/Tex		9.0	1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	5000	72	Shl/Tex		**18**		640
BENZO(g,h,i)PERYLENE	0.1		0.68	5000	720	Shl/Tex		**53**		**53**
BENZO(k)FLUORANTHENE	0.05		0.48	5000	72	Shl/Tex		**18**		37
BERYLLIUM	0.5		1.2	5000			**3.1 c**			
BIPHENYL, 1,1-		0.05		5000			3100 nc	**0.89**		4.3
BIS(2-CHLOROETHYL)ETHER		**0.66**		2500			0.59 c	0.01	0.25	110
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		2500			9.3 c	0.02	4.7	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		5000			1200 c	**100**	11000	500
BORON (Available)*										
BROMODICHLOROMETHANE		0.005		500			90 c	**0.12**		1200
BROMOFORM	0.002		0.002	2500			710 c	**0.11**	19	1100
BROMOMETHANE	0.003		0.003	2500			720 nc	12	**4.5**	3900
CADMIUM	1		1	5000			**[41] 19 nc**			
CARBON TETRACHLORIDE	0.002		0.002	2500			43 c	**1.0**	(0.28) 3.3	10000
CHLORDANE	0.05		0.05	5000			5.3 nc	5.1	200	**0.29**
CHLOROANILINE, p-		1.3		5000			[440] 210 nc	0.3		1.1
CHLOROBENZENE	0.002		0.002	2500			10000 nc	**2.4**	(32) 99	40
CHLOROFORM	0.002		0.006	2500			520 nc	**0.13**	(0.21) 11	330
CHLOROPHENOL, 2-	**0.1**		0.1	5000			1100 nc	0.0055		800
CHROMIUM (Total)	5		71							

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil ContacT	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		**5000**			100000 nc			
CHROMIUM (VI)	2.5		2.5	5000			**1100 nc**			
CHRYSENE	0.05		0.69	5000	72	Shl/Tex		**17**		100
COBALT*	2.5		21	[2500] 5000			[7200] **3400** nc			
COPPER*	5		85	**[2500]** 5000			[3400] 1600 nc			
CYANIDE (Free)	0.05		0.12	1000			**390 nc**	1000000		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	5000	**7.2**	Shl/Tex		110		140
DIBROMOCHLOROMETHANE	0.003		0.003	500			67 c	**0.09**		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500			46000 nc	**0.88**	3000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500			46000 nc	**190**		2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	2500			230 c	**0.32**	9200	2400
DICHLOROBENZIDINE, 3,3'-		1.3		5000			**2.7 c**	21		400
DDD	0.05			5000			**13 c**	3900		780
DDE	0.01			5000			**8.9 c**	22000		15000
DDT	0.05		1.4	5000			8.9 c	1200	62	**2.0**
DICHLOROETHANE, 1,1-	0.002		0.002	500			40000 nc	**3.0**	390	2200
DICHLOROETHANE, 1,2-	0.002		0.002	2500			61 c	**0.05**	0.16	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	2500			9.1 c	0.72	**0.07**	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500			5200 nc	**2.3**		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	2500			10000 nc	**4.1**		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	5000			[94] 44 nc	**0.3**		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	1000			45 c	**0.13**	0.23	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	2500			17 c	**0.04**	0.10	63
DIELDRIN	**0.06**		0.05	5000			0.15 c	0.025	2.2	0.025
DIETHYL PHTHALATE		0.66		5000			1000000 nc	130		**0.71**
DIMETHYL PHTHALATE		0.66		5000			69000 nc	1200		**0.7**
DIMETHYLPHENOL, 2,4-	0.2		0.2	5000			4400 nc	**0.94**		140
DINITROPHENOL, 2,4-	**0.2**		0.2	5000			[94] 44 nc	0.12		4.1
DINITROTOLUENE, 2,4-		**0.66**		5000			6.6 c	0.004		17
DIOXIN / FURAN (ng TEQ / g soil) *	0.002		0.007							
ENDOSULFAN	0.04			5000			[360] 170 nc	**0.18**		0.29

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil ContacT	Soil Leaching (Mod. MASS)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	5000			[15] 6.9 nc	0.56		0.014
ETHYLBENZENE	0.002		0.002	2500			28000 nc	0.28	3300	5800
ETHYLENE DIBROMIDE	0.004		0.004	500			0.066 c	0.012	0.038	320
FLUORANTHENE	0.05		1.1	5000			11000 nc	840		840
FLUORENE	0.05		0.12	5000			11000 nc	340		350
HEPTACHLOR	0.05		0.05	5000			0.68 c	11	0.91	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	5000			0.33 c	12	23	680
HEXACHLOROBENZENE	0.01			5000			2.8 c	200	130	7300
HEXACHLOROBUTADIENE	0.01			5000			39 c	2.2	4.3	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			5000			2.3 c	2.5		0.49
HEXACHLOROETHANE	0.01			5000			47 c	8.5	42	18000
INDENO(1,2,3-cd)PYRENE	0.1		0.38	5000	72	Shl/Tex		53		70
LEAD *	10		120	5000						
MERCURY	0.05		0.23	5000			[57] 27 nc			
METHOXYCHLOR	0.05		0.05	5000			[300] 140 nc	12000		4.0
METHYL ETHYL KETONE		0.1		2500			26000 nc	0.27	38	38
METHYL ISOBUTYL KETONE		0.05		1000			26000 nc	0.48	69	69
METHYL MERCURY				5000			[18] 8.4 nc			
METHYL TERT BUTYL ETHER		0.05		500			2700 nc	5.7	410	410
METHYLENE CHLORIDE	0.003		0.003	2500			740 c	1.1	1100	1100
METHYLNAPHTHALENE, 2- ('1-)	0.05		0.29	5000			[4400] 2100 nc	1.2	1600	1600
MOLYBDENUM'	2.5		2.5	5000			[550] 280 nc			
NAPHTHALENE	0.05		0.09	5000			[4400] 2100 nc	4.6	1300	1400
NICKEL	2.5		43	5000			[710] 330 nc			
PENTACHLOROPHENOL	0.1		0.1	5000			43 c	160	13000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)					100	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)					1000	MOEE 2				
PHENANTHRENE	0.05		0.69	5000	720	Shl/Tex		720		150
PHENOL	0.1		0.1	2500			[28000] 13000 nc	64	760	390
POLYCHLORINATED BIPHENYLS	0.3		0.3							
PYRENE	0.05		1	5000			8400 nc	500		250

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil ContacT	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
SELENIUM	1		1.9	[2500] 5000			[3100] 1400 nc			
SILVER	0.25		0.42	5000			[240] 110 nc			
STYRENE	0.002		0.002	2500			100 c	1.7	(6.7) 16	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500			18 c	0.39	0.46	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	2500			2.4 c	0.01	0.22	240
TETRACHLOROETHYLENE	0.002		0.002	2500			1100 c	0.45	(45) 240	760
THALLIUM	2.5		2.5	5000			150 nc			
TOLUENE	0.002		0.002	2500			88000 nc	2.1	510	4300
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-		0.66		5000			[1300] 620 nc	110	950	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500			46000 nc	34	720	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500			12 c	0.28	(1.7) 920	2900
TRICHLOROETHYLENE	0.004		0.004	500			510 nc	3.9	(2.3) 21	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	5000			22000 nc	3.2		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	5000			220 nc	0.66	12000	3200
VANADIUM'	5		91	5000			[910] 430 nc			
VINYL CHLORIDE	0.003		0.003	500			1.9 c	0.38	0.094	100
XYLENES	0.002		0.002	2500			[190000] 180000 nc	25	460	4100
ZINC	25		160	5000			[100000] 47000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57							
CHLORIDE *	0.25		330							
NITRATE *	5		61							
NITRITE *	5		61							
SODIUM ADSORPTION RATIO (SAR) ***			2.4							
SODIUM *	25									

c Cancer Risk nc Noncancer Risk [ ] S2 soil contact risk value/ceiling value shown in brackets when greater than S3 risk value.

* Soil criterion not available. ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-3 Risk value determined from human health toxicity data derived by MOEE Standard Development Branch staff.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion not applicable.

Appendix A.2.4: Table D Criteria Components - Coarse Textured Soil (Sub-Surface) - Non-Potable Groundwater Situation

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	2500				3600 nc		1300
ACENAPHTHYLENE	0.05		0.08	2500				2700 nc		840
ACETONE		0.1		1000				11000 nc	58	3.8
ALDRIN	0.05		0.05	2500				0.04 c	1.6	69
ANTHRACENE	0.05		0.16	2500				13000 nc		28
ANTIMONY	1		1	2500				44 nc		
ARSENIC	1		17	2500	40					
BARIUM	2.5		210	2500				8700 nc		
BENZENE	0.002		0.002	1000				63 c	(0.48) 89	2400
BENZO(a)ANTHRACENE	0.05		0.74	2500		190	Shl/Tex			170
BENZO(a)PYRENE	0.05		0.49	2500		1.9	Shl/Tex		1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	2500		19	Shl/Tex			640
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		190	Shl/Tex			53
BENZO(k)FLUORANTHENE	0.05		0.48	2500		19	Shl/Tex			37
BERYLLIUM	0.5		1.2	2500				0.85 c		
BIPHENYL, 1,1-		0.05		2500				6600 nc		4.3
BIS(2-CHLOROETHYL)ETHER		0.66		1000				0.16 c	0.25	110
BIS(2-CHLOROISOPROPYL)ETHER		0.66		1000				2.6 c	4.7	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500				330 c	11000	500
BORON (Available)*					2					
BROMODICHLOROMETHANE		0.005		500				25 c		1200
BROMOFORM	0.002		0.002	1000				190 c	19	1100
BROMOMETHANE	0.003		0.003	1000				150 nc	4.5	3900
CADMIUM	1		1	2500				41 nc		
CARBON TETRACHLORIDE	0.002		0.002	1000				12 c	(0.28) 3.3	10000
CHLORDANE	0.05		0.05	2500				2.0 c	200	0.29
CHLOROANILINE, p-		1.3		2500				440 nc		1.1
CHLOROBENZENE	0.002		0.002	1000				2200 nc	(32) 99	40
CHLOROFORM	0.002		0.006	1000				250 c	(0.21) 11	330
CHLOROPHENOL, 2-	0.1		0.1	2500				240 nc		800
CHROMIUM (Total)	5		71	2500						

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS										
COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		2500				22000 nc		
CHROMIUM (VI)	2.5		2.5	2500				600 nc		
CHRYSENE	0.05		0.69	2500		19	Shl/Tex			100
COBALT	2.5		21	2500				7200 nc		
COPPER	5		85	2500				3400 nc		
CYANIDE (Free)	0.05		0.12	500				100 nc		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500		1.9	Shl/Tex			140
DIBROMOCHLOROMETHANE	0.003		0.003	500				16 c		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500				9900 nc	3000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500				9900 nc		2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000				63 c	9200	2400
DICHLOROBENZIDINE, 3,3'-		1.3		2500				0.72 c		400
DDD	0.05			2500				3.5 c		780
DDE	0.01			2500				2.4 c		15000
DDT	0.05		1.4	2500				2.4 c	62	2.0
DICHLOROETHANE, 1,1-	0.002		0.002	500				8500 nc	390	2200
DICHLOROETHANE, 1,2-	0.002		0.002	1000				17 c	0.16	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000				2.5 c	0.07	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500		2.3	Table C*	1100 nc		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000		4.1	Table C*	2200 nc		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	2500				94 nc		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	500				12 c	0.23	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	1000				4.6 c	0.1	63
DIELDRIN	0.05		0.05	2500				0.04 c	2.2	0.025
DIETHYL PHTHALATE		0.66		2500				270000 nc		0.71
DIMETHYL PHTHALATE		0.66		2500				150000 nc		0.7
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500				940 nc		140
DINITROPHENOL, 2,4-	0.2		0.2	2500				94 nc		4.1
DINITROTOLUENE, 2,4-		0.66		2500				1.8 c		17
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007			1	CCME			
ENDOSULFAN	0.04			2500				360 nc		0.29

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	2500				15 nc		0.014
ETHYLBENZENE	0.002		0.002	1000				6000 nc	3300	5800
ETHYLENE DIBROMIDE	0.004		0.004	500				0.02 c	0.038	320
FLUORANTHENE	0.05		1.1	2500				2400 nc		840
FLUORENE	0.05		0.12	2500				2400 nc		350
HEPTACHLOR	0.05		0.05	2500				0.18 c	0.91	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	2500				0.09 c	23	680
HEXACHLOROBENZENE	0.01			2500				0.76 c	130	7300
HEXACHLOROBUTADIENE	0.01			2500				11 c	4.3	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500				0.64 c		0.49
HEXACHLOROETHANE	0.01			2500				13 c	42	18000
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		19	Sh/Tex			70
LEAD	10		120	2500		1000	MOEE 1			
MERCURY	0.05		0.23	2500				57 nc		
METHOXYCHLOR	0.05		0.05	2500				300 nc		4.0
METHYL ETHYL KETONE		0.1		1000				66000 nc	38	38
METHYL ISOBUTYL KETONE		0.05		500				5500 nc	69	69
METHYL MERCURY				2500				18 nc		
METHYL TERT BUTYL ETHER		0.05		500				570 nc	410	410
METHYLENE CHLORIDE	0.003		0.003	1000				200 c	1100	1100
METHYLNAPHTHALENE, 2- ("1-)	0.05		0.29	2500				4400 nc	1600	1600
MOLYBDENUM	2.5		2.5	2500				550 nc		
NAPHTHALENE	0.05		0.09	1000				4400 nc	1300	1400
NICKEL	2.5		43	2500				710 nc		
PENTACHLOROPHENOL	0.1		0.1	2500				12 c	13000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)						5000	MOEE 2			
PETROLEUM HYDROCARBONS (heavy oils)						5000	MOEE 2			
PHENANTHRENE	0.05		0.69	2500		190	Sh/Tex			150
PHENOL	0.1		0.1	1000				28000 nc	760	390
POLYCHLORINATED BIPHENYLS	0.3		0.3			25	CCME			
PYRENE	0.05		1	2500				1800 nc		250

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS

COARSE TEXTURED SOILS	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
SELENIUM	1		1.9	2500				3100 nc		
SILVER	0.25		0.42	2500				240 nc		
STYRENE	0.002		0.002	1000				28 c	(6.7) 16	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500				4.9 c	0.46	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000				0.64 c	0.22	240
TETRACHLOROETHYLENE	0.002		0.002	1000		0.45	Table C^a^	290 c	(45) 240	760
THALLIUM	2.5		2.5	2500				32 nc		
TOLUENE	0.002		0.002	1000				19000 nc	610	4300
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-		0.66		2500				1300 nc	950	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500		34	Table C^a^	9900 nc	720	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500				3.1 nc	(1.7) 920	2900
TRICHLOROETHYLENE	0.004		0.004	500		3.9	Table C^a^	140 c	(2.3) 21	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500				4700 nc		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500				59 c	12000	3200
VANADIUM	5		91	2500				910 nc		
VINYL CHLORIDE	0.003		0.003	500				0.50 c	0.094	100
XYLENES	0.002		0.002	1000				190000 nc	460	4100
ZINC	25		160	2500				100000 nc		
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57							
CHLORIDE ^	0.25		330							
NITRATE ^	5		61							
NITRITE ^	5		61							
SODIUM ADSORPTION RATIO (SAR) ***			2.4							
SODIUM ^	25									

c Cancer Risk nc Noncancer Risk + S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

a Soil criterion from Table C (potable groundwater situation) adopted to account for degradation to vinyl chloride.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion. *** Soil criterion not applicable. ^ Soil criterion not available

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS.

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	5000			17000 nc		**1300**
ACENAPHTHYLENE	0.05		0.08	5000			[2700] 1200 nc		**840**
ACETONE		0.1		2500			52000 nc	58	**3.8**
ALDRIN	0.05		0.05	5000			**0.15 c**	1.6	69
ANTHRACENE	0.05		0.16	5000			60000 nc		**28**
ANTIMONY	1		1	5000			**[44] 21 nc**		
ARSENIC *	1		17	5000					
BARIUM	2.5		210	[2500] 5000			**[8700] 4100 nc**		
BENZENE	0.002		0.002	2500			230 c	**(0.48) 89**	2400
BENZO(a)ANTHRACENE	0.05		0.74	5000	720	Shl/Tex			**170**
BENZO(a)PYRENE	0.05		0.49	5000	**7.2**	Shl/Tex		1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	5000	**72**	Shl/Tex			640
BENZO(g,h,i)PERYLENE	0.1		0.68	5000	720	Shl/Tex			**53**
BENZO(k)FLUORANTHENE	0.05		0.48	5000	72	Shl/Tex			**37**
BERYLLIUM	0.5		1.2	5000			**3.1 c**		
BIPHENYL, 1,1-		0.05		5000			3100 nc		**4.3**
BIS(2-CHLOROETHYL)ETHER		**0.66**		2500			0.59 c	0.25	110
BIS(2-CHLOROISOPROPYL)ETHER		0.66		2500			9.3 c	**4.7**	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		5000			1200 c	11000	**600**
BORON (Available)*									
BROMODICHLOROMETHANE		0.005		500			**90 c**		1200
BROMOFORM	0.002		0.002	2500			710 c	**19**	1100
BROMOMETHANE	0.003		0.003	2500			720 nc	**4.5**	3900
CADMIUM	1		1	5000			**[41] 19 nc**		
CARBON TETRACHLORIDE	0.002		0.002	2500			43 nc	**(0.28) 3.3**	10000
CHLORDANE	0.05		0.05	5000			5.3 nc	200	**0.29**
CHLOROANILINE, p-		**1.3**		5000			[440] 210 nc		1.1
CHLOROBENZENE	0.002		0.002	2500			10000 nc	(32) 99	**40**
CHLOROFORM	0.002		0.006	2500			520 nc	**(0.21) 11**	330
CHLOROPHENOL, 2-	0.1		0.1	5000			1100 nc		**800**
CHROMIUM (Total)	5		71						

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS.									
COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		5000			10000 nc		
CHROMIUM (VI)	2.5		2.5	5000			1100 nc		
CHRYSENE	0.05		0.69	5000	72	Shl/Tex			100
COBALT	2.5		21	[2500] 5000			[7200] 3400 nc		
COPPER	5		85	[2500] 5000			[3400] 1600 nc		
CYANIDE (Free)	0.05		0.12	1000			390 nc		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	5000	7.2	Shl/Tex			140
DIBROMOCHLOROMETHANE	0.003		0.003	500			67 c		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500			46000 nc	3000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500			46000 nc		2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	2500			230 c	9200	2400
DICHLOROBENZIDINE, 3,3'-		1.3		5000			2.7 c		400
DDD	0.05			5000			13 c		780
DDE	0.01			5000			8.9 c		15000
DDT	0.05		1.4	5000			8.9 c	62	2.0
DICHLOROETHANE, 1,1-	0.002		0.002	500			40000 nc	390	2200
DICHLOROETHANE, 1,2-	0.002		0.002	2500			61 c	0.16	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	2500			9.1 c	0.07	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500	2.3	Table C*	5200 nc		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	2500	4.1	Table C*	10000 nc		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	5000			[94] 44 nc		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	1000			45 c	0.23	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	2500			17 c	0.10	63
DIELDRIN	0.05		0.05	5000			0.15 c	2.2	0.025
DIETHYL PHTHALATE		0.66		5000			1000000 nc		0.71
DIMETHYL PHTHALATE		0.66		5000			69000 nc		0.7
DIMETHYLPHENOL, 2,4-	0.2		0.2	5000			4400 nc		140
DINITROPHENOL, 2,4-	0.2		0.2	5000			[94] 44 nc		4.1
DINITROTOLUENE, 2,4-		0.66		5000			6.6 c		17
DIOXIN / FURAN (ng TEQ / g soil) *	0.002		0.007						
ENDOSULFAN	0.04			5000			[360] 170 nc		0.29

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS.

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
ENDRIN	**0.05**		0.05	5000			[15] 6.9 nc		0.014
ETHYLBENZENE	0.002		0.002	**2500**			28000 nc	3300	5800
ETHYLENE DIBROMIDE	0.004		0.004	500			0.066 c	**0.038**	320
FLUORANTHENE	0.05		1.1	5000			11000 nc		**840**
FLUORENE	0.05		0.12	5000			11000 nc		**350**
HEPTACHLOR	0.05		0.05	5000			0.68 c	0.91	**0.15**
HEPTACHLOR EPOXIDE	0.05		0.05	5000			**0.33 c**	23	680
HEXACHLOROBENZENE	0.01			5000			**2.8 c**	130	7300
HEXACHLOROBUTADIENE	0.01			5000			39 c	**4.3**	460
HCH-gamma	0.01			5000			2.3 c		**0.49**
HEXACHLOROETHANE	0.01			5000			47 c	**42**	18000
INDENO(1,2,3-cd)PYRENE	0.1		0.38	5000	72	Shl/Tex			**70**
LEAD *	10		120	5000					
MERCURY	0.05		0.23	5000			**[57] 27 nc**		
METHOXYCHLOR	0.05		0.05	5000			[300] 140 nc		**4.0**
METHYL ETHYL KETONE		0.1		2500			26000 nc	**38**	**38**
METHYL ISOBUTYL KETONE		0.05		1000			26000 nc	**69**	**69**
METHYL MERCURY				5000			**[18] 8.4 nc**		
METHYL TERT BUTYL ETHER		0.05		500			2700 nc	**410**	**410**
METHYLENE CHLORIDE	0.003		0.003	2500			**740 c**	1100	1100
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	5000			[4400] 2100 nc	**1600**	**1600**
MOLYBDENUM	2.5		2.5	5000			**[550] 260 nc**		
NAPHTHALENE	0.05		0.09	5000			[4100] 2100 nc	**1300**	1400
NICKEL	2.5		43	5000			**[710] 330 nc**		
PENTACHLOROPHENOL	0.1		0.1	5000			**43 c**	13000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)					**5000**	MOEE 2			
PETROLEUM HYDROCARBONS (heavy oils)					**5000**	MOEE 2			
PHENANTHRENE	0.05		0.69	5000	720	Shl/Tex			**150**
PHENOL	0.1		0.1	2500			[28000] 13000 nc	760	**390**
POLYCHLORINATED BIPHENYLS *	0.3		0.3						
PYRENE	0.05		1	5000			8400 nc		**250**

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - COARSE TEXTURED SOILS.

COARSE TEXTURED SOILS	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
SELENIUM	1		1.9	(2600) 5000			[3100] 1400 nc		
SILVER	0.25		0.42	5000			[240] 110 nc		
STYRENE	0.002		0.002	2500			100 c	(6.7) 16	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500			18 c	0.46	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	2500			2.4 c	0.22	240
TETRACHLOROETHYLENE	0.002		0.002	2500	0.45	Table C*	1100 c	(45) 240	760
THALLIUM	2.5		2.5	5000			150 nc		
TOLUENE	0.002		0.002	2500			88000 nc	510	4300
TPH - refer to PETROLEUM HYDROCARBONS									
TRICHLOROBENZENE, 1,2,4-		0.66		5000			[1300] 620 nc	950	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500	34	Table C*	46000 nc	720	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500			12 c	(1.7) 920	2900
TRICHLOROETHYLENE	0.004		0.004	500	3.9	Table C*	510 nc	(2.3) 21	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	5000			22000 nc		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	5000			220 nc	12000	3200
VANADIUM	5		91	5000			[910] 430 nc		
VINYL CHLORIDE	0.003		0.003	500			1.9 c	0.094	100
XYLENES	0.002		0.002	2500			[190000] 180000 nc	460	4100
ZINC	25		160	5000			[100000] 47000 nc		
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57						
CHLORIDE *	0.25		330						
NITRATE *	5		61						
NITRITE *	5		61						
SODIUM ADSORPTION RATIO (SAR) ***			2.4						
SODIUM *	25								

c Cancer Risk nc Noncancer Risk [ ] S2 soil contact risk value/ceiling value shown in brackets if greater than S3 risk value.

* Soil criterion is not available. ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-3 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

a Soil criterion adopted from Table C (potable groundwater situation) to account for degradation to vinyl chloride.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion is not applicable.

Appendix A.2.5: Table A Criteria Components - Medium/Fine Textured Soil (Surface/Full Depth) - Potable Groundwater Situation

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.05	1000					1400 nc	**15**		1300	
ACENAPHTHYLENE	0.05		0.08	**100**					1000 nc	130		840	
ACETONE		0.1		500					3400 nc	**3.5**	58	3.8	12000
ALDRIN	**0.05**		0.05	1000		0.35			0.026 c	0.08	11	69	0.93
ANTHRACENE	0.05		0.05	1000		40			5300 nc	1500		**28**	
ANTIMONY	1		1	1000	25				**13 nc**				
ARSENIC	1		14	1000	**25**								
BARIUM*	2.5		190	1000	**1000**				3700 nc				
BENZENE	0.002		0.002	500		25			35 c	**0.24**	(3.0) 580	2400	(0.19) 33
BENZO(a)ANTHRACENE	0.05		0.1	1000		40	120	Shl/Tex		**6.6**		170	
BENZO(a)PYRENE	0.05		0.1	1000		40	**1.2**	Shl/Tex		9.0	1700	1700	300000
BENZO(b)FLUORANTHENE	0.05		0.3	1000			**12**	Shl/Tex		18		640	
BENZO(g,h,i)PERYLENE	0.1		0.2	1000		**40**	120	Shl/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.05	1000		40	**12**	Shl/Tex		18		37	
BERYLLIUM	0.5		**1.2**	1000	5				0.37 c				
BIPHENYL, 1,1-		0.05		1000					1900 nc	**0.89**		4.3	
BIS(2-CHLOROETHYL)ETHER		**0.66**		500					0.12 c	0.01	1.5	110	0.81
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		500					1.9 c	0.024	29	540	5.1
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					130 c	**100**	11000	500	1000000
BORON (Available)*					**1.5**								
BROMODICHLOROMETHANE		0.005		100					14 c	**0.12**		1200	
BROMOFORM	0.002		0.002	500					110 c	**0.11**	120	1100	14
BROMOMETHANE	0.003		0.003	500					47 nc	12	20	3900	**0.38**
CADMIUM **	1		1	1000	**4**				14 nc				
CARBON TETRACHLORIDE	0.002		0.002	500					6.8 c	1.0	(1.8) 20	10000	(0.044) **0.64**
CHLORDANE	0.05		0.05	1000					0.99 c	51	200	**0.29**	110
CHLOROANILINE, p-		**1.3**		100					130 nc	0.3		1.1	
CHLOROBENZENE	0.002		0.002	500		30			670 nc	**2.4**	(200) 620	40	(20) 50
CHLOROFORM	0.002		0.006	500					140 c	**0.13**	(1.3) 71	330	(0.069) 4.9
CHLOROPHENOL, 2-	**0.1**		0.1	1000		10			95 nc	0.0055		800	
CHROMIUM (Total)	5		67	1000	**1000**								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc				
CHROMIUM (VI)	2.5		2.5	1000	**10**				180 nc				
CHRYSENE	0.05		0.18	1000		40	**12**	Sh/Tex		17		100	
COBALT*	2.5		19	1000	**50**				2700 nc				
COPPER*	5		56	1000	**200**				1100 nc				
CYANIDE (Free)	0.05		0.12	100					**100 nc**	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.15	1000			**1.2**	Sh/Tex		110		140	
DIBROMOCHLOROMETHANE	0.003		0.003	100					10 c	**0.09**		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	**0.88**	15000	2300	1700
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	100		**30**			3000 nc	190	15000	2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	500		30			37 c	**0.32**	13000	2400	5200
DICHLOROBENZIDINE, 3,3'-		**1.3**		1000					0.51 c	21		400	
DDD	0.05			1000					**2.2 c**	3900		780	
DDE	0.01			1000		4			**1.6 c**	22000		15000	
DDT	0.05		0.12	1000		4			**1.6 c**	1200	64	2.0	2900
DICHLOROETHANE, 1,1-	0.002		0.002	100					2600 nc	**3.0**	2200	2200	140
DICHLOROETHANE, 1,2-	0.002		0.002	500		60			9.6 c	**0.05**	1.0	460	0.14
DICHLOROETHYLENE, 1,1-	0.002		0.002	500					1.4 c	0.72	0.42	5200	**0.015**
DICHLOROETHYLENE, CIS-1,2-		0.005		100					340 nc	**2.3**		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	500					670 nc	**4.1**		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	100		10			41 nc	**0.3**		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	100					7.9 c	0.13	1.5	1300	**0.12**
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	**0.04**	0.62	63	0.041
DIELDRIN	**0.05**		0.05	1000		4			0.028 c	0.025	14	0.025	1.3
DIETHYL PHTHALATE		0.66		1000					44000 nc	130		**0.71**	
DIMETHYL PHTHALATE		0.66		1000					39000 nc	1200		**0.7**	
DIMETHYLPHENOL, 2,4-	0.2		0.2	1000					380 nc	**0.94**		140	
DINITROPHENOL, 2,4-	**0.2**		0.2	1000					38 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		**0.68**		1000					1.1 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				**0.01**	CCME					
ENDOSULFAN	0.04			1000					140 nc	**0.18**		0.29	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc	0.56		0 014	
ETHYLBENZENE	0.002		0.002	500					2300 nc	0.28	5800	5800	1800
ETHYLENE DIBROMIDE	0 004		0.004	100					0.01 c	0.012	0.24	320	0.035
FLUORANTHENE	0.05		0.24	1000		40			910 nc	840		840	
FLUORENE	0 05		0.05	1000					910 nc	340		350	
HEPTACHLOR	0 05		0.05	1000					0.12 c	11	5.8	0.15	0 53
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	12	140	680	13
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	200	780	7300	71
HEXACHLOROBUTADIENE	0.01			100					6 9 c	2.2	27	460	2.4
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c	2.5		0 49	
HEXACHLOROETHANE	0 01			100					6.3 nc	8.5	260	1800	24
INDENO(1,2,3-cd)PYRENE	0.1		0.11	1000		40	12	Shl/Tex		53		70	
LEAD	10		55	1000		200	200	MOEE 1					
MERCURY	0.05		0.16	1000		10			13 nc				
METHOXYCHLOR	0.05		0.05	1000					110 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	0.27	38	38	11000
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	0.48	69	69	360
METHYL MERCURY				1000		10			6.8 nc				
METHYL TERT BUTYL ETHER		0.05		100					170 nc	5.7	410	410	740
METHYLENE CHLORIDE	0.003		0.003	500					120 c	1.1	1100	1100	840
METHYLNAPHTHALENE, 2- (*1-)	0 05		0 05	1000					1300 nc	1.2	1600	1600	1800
MOLYBDENUM*	2 5		2 5	1000	5				170 nc				
NAPHTHALENE	0 05		0.05	100		40			1300 nc	4.6	3500	1400	760
NICKEL	2.5		43	1000	200				310 nc				
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.8 c	160	37000	680	7300
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0 19	1000		40	120	Shl/Tex		720		150	
PHENOL	0 1		0 1	500		40			11000 nc	64	760	390	290000
POLYCHLORINATED BIPHENYLS	0 3		0 3				0.5	CCME					
PYRENE	0 05		0.19	1000					680 nc	500		250	

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MEDIUM/FINE TEXTURED SOIL	AGRICULTURAL CATEGORY (all depths) (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd	Value	MOEE	Nath C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.4	1000	2				320 nc				
SILVER	0.25		0.35	1000	25				98 nnc				
STYRENE	0.002		0.002	500					18 c	1.7	(42) 99	840	(2.8) 7.7
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	0.39	2.9	3900	0.12
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	0.01	1.4	240	0.23
TETRACHLOROETHYLENE	0.002		0.002	500		60			170 c	0.45	(280) 1500	760	(24) 140
THALLIUM	2.5		2.5	1000					4.1 nc				
TOLUENE	0.002		0.002	500		150			6100 nc	2.1	3200	4300	210
TPH - refer to PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	110	6000	770	540
TRICHLOROETHANE, 1,1,1-	0.002		0.008	100					3000 nc	34	4400	8500	160
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	0.28	(11) 2900	2900	(1.2) 580
TRICHLOROETHYLENE	0.004		0.004	100		60			67 nc	3.9	(14) 130	3900	(0.71) 6.6
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	0.66	17000	3200	7200
VANADIUM*	5		91	1000	250				470 nc				
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.38	0.25	100	0.0075
XYLENES	0.002		0.002	500					61000 nc	25	2900	4100	210
ZINC	25		150	1000	800				16000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.47		0.7								
CHLORIDE***	0.25		58										
NITRATE***	5		40										
NITRITE***	5		40										
SODIUM ADSORPTION RATIO (SAR)			1		5								
SODIUM***	25												

c Cancer Risk nc Noncancer Risk

+ S-1 Risk Value determined from human health toxicity data derived by MOEE Standard Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** MOEE Soil Clean-up Guideline (SCUG) for cadmium (coarse textured soil) is based on human health, but is applied here for the protection of grazing animals. *** Soil criterion is not available.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	1000					1400 nc	15		1300	
ACENAPHTHYLENE	0.05		0.08	100					1000 nc	130		840	
ACETONE		0.1		500					3400 nc	3.5	58	3.8	12000
ALDRIN	0.05		0.05	1000		0.35			0.026 c	0.08	11	69	0.93
ANTHRACENE	0.05		0.16	1000		40			5300 nc	1500		28	
ANTIMONY	1		1	1000	25				13 nc				
ARSENIC	1		17	1000	25								
BARIUM*	2.5		210	1000	1000				3700 nc				
BENZENE	0.002		0.002	500		25			35 c	0.24	(3.0) 580	2400	(0.19) 33
BENZO(a)ANTHRACENE	0.05		0.74	1000		40	120	Sh/Tex		6.6		170	
BENZO(a)PYRENE	0.05		0.49	1000		40	1.2	Sh/Tex		9.0	1700	1700	300000
BENZO(b)FLUORANTHENE	0.05		0.47	1000			12	Sh/Tex		18		640	
BENZO(g,h,i)PERYLENE	0.1		0.68	1000		40	120	Sh/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.48	1000		40	12	Sh/Tex		18		37	
BERYLLIUM	0.5		1.2	1000	5				0.37 c				
BIPHENYL, 1,1-		0.05		1000					1900 nc	0.89		4.3	
BIS(2-CHLOROETHYL)ETHER		0.66		500					0.12 c	0.01	1.5	110	0.81
BIS(2-CHLOROISOPROPYL)ETHER		0.66		500					1.9 c	0.024	29	540	5.1
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					130 c	100	11000	500	1000000
BORON (Available)*					1.5								
BROMODICHLOROMETHANE		0.005		100					14 c	0.12		1200	
BROMOFORM	0.002		0.002	500					110 c	0.11	120	1100	14
BROMOMETHANE	0.003		0.003	500					47 nc	12	20	3900	0.38
CADMIUM	1		1	1000		12			14 nc				
CARBON TETRACHLORIDE	0.002		0.002	500					6.8 c	1.0	(1.8) 20	10000	(0.044) 0.54
CHLORDANE	0.05		0.05	1000					0.99 c	51	200	0.29	110
CHLOROANILINE, p-		1.3		100					130 nc	0.3		1.1	
CHLOROBENZENE	0.002		0.002	500		30			670 nc	2.4	(200) 620	40	(20) 50
CHLOROFORM	0.002		0.006	500					140 c	0.13	(1.3) 71	330	(0.069) 4.9
CHLOROPHENOL, 2-	0.1		0.1	1000		10			95 nc	0.0055		800	
CHROMIUM (Total)	5		71	1000	1000								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc				
CHROMIUM (VI)	2.5		2.5	1000	10				180 nc				
CHRYSENE	0.05		0.69	1000		40	12	Shl/Tex		17		100	
COBALT'	2.5		21	1000	50				2700 nc				
COPPER'	5		85	1000	300				1100 nc				
CYANIDE (Free)	0.05		0.12	100					100 nc	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	1000			1.2	Shl/Tex		110		140	
DIBROMOCHLOROMETHANE	0.003		0.003	100					10 c	0.09		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	0.88	15000	2300	1700
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	100		30			3000 nc	190	15000	2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	500		30			37 c	0.32	13000	2400	5200
DICHLOROBENZIDINE, 3,3'-		1.3		1000					0.51 c	21		400	
DDD	0.05			1000					2.2 c	3900		780	
DDE	0.01			1000		4			1.6 c	22000		15000	
DDT	0.05		1.4	1000		4			1.6 c	1200	64	2.0	2900
DICHLOROETHANE, 1,1-	0.002		0.002	100					2600 nc	3.0	2200	2200	140
DICHLOROETHANE, 1,2-	0.002		0.002	500		60			9.6 c	0.05	1.0	460	0.14
DICHLOROETHYLENE, 1,1-	0.002		0.002	500					1.4 c	0.72	0.42	5200	0.015
DICHLOROETHYLENE, CIS-1,2-		0.005		100					340 nc	2.3		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	500					670 nc	4.1		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	100		10			41 nc	0.3		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	100					7.9 c	0.13	1.5	1300	0.12
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	0.04	0.62	63	0.041
DIELDRIN	0.05		0.05	1000		4			0.028 c	0.025	14	0.025	1.3
DIETHYL PHTHALATE		0.66		1000					44000 nc	130		0.71	
DIMETHYL PHTHALATE		0.66		1000					39000 nc	1200		0.7	
DIMETHYLPHENOL, 2,4-	0.2		0.2	1000					380 nc	0.94		140	
DINITROPHENOL, 2,4-	0.2		0.2	1000					38 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		0.66		1000					1.1 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				1	CCME					
ENDOSULFAN	0.04			1000					140 nc	0.18		0.29	

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MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc	0.56		0.014	
ETHYLBENZENE	0.002		0.002	500					2300 nc	0.28	5800	5800	1800
ETHYLENE DIBROMIDE	0.004		0.004	100					0.01 c	0.012	0.24	320	0.035
FLUORANTHENE	0.05		1.1	1000		40			910 nc	840		840	
FLUORENE	0.05		0.12	1000					910 nc	340		350	
HEPTACHLOR	0.05		0.05	1000					0.12 c	11	5.8	0.15	0.53
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	12	140	680	13
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	200	780	7300	71
HEXACHLOROBUTADIENE	0.01			100					6.9 c	2.2	27	460	2.4
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c	2.5		0.49	
HEXACHLOROETHANE	0.01			100					6.3 nc	8.5	260	1800	24
INDENO(1,2,3-cd)PYRENE	0.1		0.38	1000		40	12	Sh/Tex		53		70	
LEAD	10		120	1000		200	200	MOEE 1					
MERCURY	0.05		0.23	1000		10			13 nc				
METHOXYCHLOR	0.05		0.05	1000					110 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	0.27	38	38	11000
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	0.48	69	69	360
METHYL MERCURY				1000		10			6.8 nc				
METHYL TERT BUTYL ETHER		0.05		100					170 nc	5.7	410	410	740
METHYLENE CHLORIDE	0.003		0.003	500					120 c	1.1	1100	1100	840
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	1000					1300 nc	1.2	1600	1600	1800
MOLYBDENUM'	2.5		2.5	1000	40				170 nc				
NAPHTHALENE	0.05		0.09	100		40			1300 nc	4.6	3500	1400	760
NICKEL	2.5		43	1000	200				310 nc				
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.9 c	160	37000	680	7300
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0.69	1000		40	120	Sh/Tex		720		150	
PHENOL	0.1		0.1	500		40			11000 nc	64	760	390	290000
POLYCHLORINATED BIPHENYLS	0.3		0.3				5	CCME					
PYRENE	0.05		1	1000					680 nc	500		250	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	1000	10				320 nc				
SILVER	0.25		0.42	1000	25				98 nc				
STYRENE	0.002		0.002	500					18 c	1.7	(42) 99	840	(2.8) 7.7
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	0.39	2.9	3900	0.12
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	0.01	1.4	240	0.23
TETRACHLOROETHYLENE	0.002		0.002	500		60			170 c	0.45	(280) 1500	760	(24) 140
THALLIUM	2.5		2.5	1000					4.1 nc				
TOLUENE	0.002		0.002	500		150			6100 nc	2.1	3200	4300	210
TPH - *refer to* PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	110	6000	770	540
TRICHLOROETHANE, 1,1,1-	0.002		0.009	100					3000 nc	34	4400	8500	160
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	0.28	(11) 2900	2900	(1.2) 580
TRICHLOROETHYLENE	0.004		0.004	100		60			67 nc	3.9	(14) 130	3900	(0.71) 6.6
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	0.66	17000	3200	7200
VANADIUM*	5		91	1000	250				470 nc				
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.38	0.25	100	0.0075
XYLENES	0.002		0.002	500					61000 nc	25	2900	4100	210
ZINC	25		160	1000	800				16000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		0.7								
CHLORIDE**	0.25		330										
NITRATE**	5		61										
NITRITE**	5		61										
SODIUM ADSORPTION RATIO (SAR)			2.4		5								
SODIUM**	25												

c Cancer Risk nc Noncancer Risk

+ S1 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in soil, the sum of the two concentrations cannot exceed the soil criterion.

** Soil criterion not available.

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)													
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	2500					3600 nc	15		1300	
ACENAPHTHYLENE	0.05		0.08	2500					2700 nc	130		840	
ACETONE		0.1		1000					11000 nc	3.5	58	3.8	12000
ALDRIN	0.05		0.05	2500		0.35			0.04 c	0.08	11	69	0.93
ANTHRACENE	0.05		0.16	2500		40			13000 nc	1500		28	
ANTIMONY	1		1	2500	50				44 nc				
ARSENIC	1		17	2500	50								
BARIUM*	2.5		210	2500	2000				8700 nc				
BENZENE	0.002		0.002	1000		25			63 c	0.24	(3.0) 580	2400	(0.19) 33
BENZO(a)ANTHRACENE	0.05		0.74	2500		40	190	Shl/Tex		6.6		170	
BENZO(a)PYRENE	0.05		0.49	2500		40	1.9	Shl/Tex		9.0	1700	1700	300000
BENZO(b)FLUORANTHENE	0.05		0.47	2500			19	Shl/Tex		18		640	
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		40	190	Shl/Tex		53		53	
BENZO(k)FLUORANTHENE	0.05		0.48	2500		40	19	Shl/Tex		18		37	
BERYLLIUM	0.5		1.2	2500	10				0.85 c				
BIPHENYL, 1,1-		0.05		2500					6600 nc	0.89		4.3	
BIS(2-CHLOROETHYL)ETHER		0.66		1000					0.16 c	0.01	1.5	110	0.81
BIS(2-CHLOROISOPROPYL)ETHER		0.66		1000					2.6 c	0.024	29	540	5.1
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500					330 c	100	11000	500	1000000
BORON (Available)*					2								
BROMODICHLOROMETHANE		0.005		500					25 c	0.12		1200	
BROMOFORM	0.002		0.002	1000					190 c	0.11	120	1100	14
BROMOMETHANE	0.003		0.003	1000					150 nc	12	20	3900	0.38
CADMIUM	1		1	2500		12			41 nc				
CARBON TETRACHLORIDE	0.002		0.002	1000					12 c	1.0	(1.8) 20	10000	(0.044) 0.64
CHLORDANE	0.05		0.05	2500					2.0 c	51	200	0.29	110
CHLOROANILINE, p-		1.3		2500					440 nc	0.3		1.1	
CHLOROBENZENE	0.002		0.002	1000		30			2200 nc	2.4	(200) 620	40	(20) 50
CHLOROFORM	0.002		0.006	1000					250 c	0.13	(1.3) 71	330	(0.069) 4.9
CHLOROPHENOL, 2-	0.1		0.1	2500		10			240 nc	0.0055		800	
CHROMIUM (Total)	5		71	2500	1000								

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		2500		230			220000 nc				
CHROMIUM (VI)	2.5		2.5	2500	**10**				600 nc				
CHRYSENE	0.05		0.69	2500		40	19	Shl/Tex		**17**		100	
COBALT'	2.5		21	2500	**100**				7200 nc				
COPPER'	5		85	2500	**300**				3400 nc				
CYANIDE (Free)	0.05		0.12	500					**100 nc**	1000000		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500			**1.9**	Shl/Tex		110		140	
DIBROMOCHLOROMETHANE	0.003		0.003	500					18 c	**0.09**		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500		30			9900 nc	**0.88**	15000	2300	1700
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500		**30**			9900 nc	190	15000	2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000		30			63 c	**0.32**	13000	2400	5200
DICHLOROBENZIDINE, 3,3'-		**1.3**		2500					0.72 c	21		400	
DDD	0.05			2500					**3.5 c**	3900		780	
DDE	0.01			2500		4			**2.4 c**	22000		15000	
DDT	0.05		1.4	2500		4			2.4 c	1200	64	**2.0**	2900
DICHLOROETHANE, 1,1-	0.002		0.002	500					8500 nc	**3.0**	2200	2200	140
DICHLOROETHANE, 1,2-	0.002		0.002	1000		60			17 c	**0.05**	1.0	460	0.14
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000					2.5 c	0.72	0.42	5200	**0.015**
DICHLOROETHYLENE, CIS-1,2-		0.005		500					1100 nc	**2.3**		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000					2200 nc	**4.1**		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	2500		10			94 nc	**0.3**		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	500					12 c	0.13	1.5	1300	**0.12**
DICHLOROPROPENE, 1,3-	0.003		0.003	1000					4.6 c	**0.04**	0.62	63	0.041
DIELDRIN	**0.05**		0.05	2500		4			0.04 c	0.025	14	0.025	1.3
DIETHYL PHTHALATE		0.66		2500					270000 nc	130		**0.71**	
DIMETHYL PHTHALATE		0.66		2500					150000 nc	1200		**0.7**	
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500					940 nc	**0.94**		140	
DINITROPHENOL, 2,4-	**0.2**		0.2	2500					94 nc	0.12		4.1	
DINITROTOLUENE, 2,4-		**0.66**		2500					1.8 c	0.004		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				**1**	CCME					
ENDOSULFAN	0.04			2500					360 nc	**0.18**		0.29	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	2500		0.06			15 nc	0.56		0.014	
ETHYLBENZENE	0.002		0.002	1000					6000 nc	0.28	5800	5800	1800
ETHYLENE DIBROMIDE	0.004		0.004	500					0.02 c	0.012	0.24	320	0.035
FLUORANTHENE	0.05		1.1	2500		40			2400 nc	840		840	
FLUORENE	0.05		0.12	2500					2400 nc	340		350	
HEPTACHLOR	0.05		0.05	2500					0.18 c	11	5.8	0.15	0.53
HEPTACHLOR EPOXIDE	0.05		0.05	2500					0.09 c	12	140	680	13
HEXACHLOROBENZENE	0.01			2500		30			0.76 c	200	780	7300	71
HEXACHLOROBUTADIENE	0.01			2500					11 c	2.2	27	460	2.4
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500		2			0.64 c	2.5		0.49	
HEXACHLOROETHANE	0.01			2500					13 c	8.5	260	1800	24
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		40	19	Shl/Tex		53		70	
LEAD	10		120	2500			1000	MOEE 1					
MERCURY	0.05		0.23	2500		10			57 nc				
METHOXYCHLOR	0.05		0.05	2500					300 nc	12000		4.0	
METHYL ETHYL KETONE		0.1		1000					66000 nc	0.27	38	38	11000
METHYL ISOBUTYL KETONE		0.05		500					5500 nc	0.48	69	69	360
METHYL MERCURY **				2500		10			18 nc				
METHYL TERT BUTYL ETHER		0.05		500					570 nc	5.7	410	410	740
METHYLENE CHLORIDE	0.003		0.003	1000					200 c	1.1	1100	1100	840
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	2500					4400 nc	1.2	1600	1600	1800
MOLYBDENUM*	2.5		2.5	2500	40				550 nc				
NAPHTHALENE	0.05		0.09	2500		40			4400. nc	4.6	3500	1400	760
NICKEL	2.5		43	2500	200				710 nc				
PENTACHLOROPHENOL	0.1		0.1	2500		5			12 c	160	37000	680	7300
PETROLEUM HYDROCARBONS (gasoline/diesel)							100	MOEE 2					
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2					
PHENANTHRENE	0.05		0.69	2500		40	190	Shl/Tex		720		150	
PHENOL	0.1		0.1	1000		40			28000 nc	64	760	390	290000
POLYCHLORINATED BIPHENYLS	0.3		0.3				25	CCME					
PYRENE	0.05		1	2500					1800 nc	500		250	

TABLE A: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)												
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)			Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	2500	10				3100 nc				
SILVER	0.25		0.42	2500	50				240 nc				
STYRENE	0.002		0.002	1000					28 c	1.7	(42) 99	840	(2.8) 7.7
TETRACHLOROETHANE, 1,1,1,2-		0.005		500					4.9 c	0.39	2.9	3900	0.12
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000					0.84 c	0.01	1.4	240	0.23
TETRACHLOROETHYLENE	0.002		0.002	1000		60			290 c	0.45	(280) 1500	760	(24) 140
THALLIUM	2.5		2.5	2500					32 nc				
TOLUENE	0.002		0.002	1000		150			19000 nc	2.1	3200	4300	210
TPH - refer to PETROLEUM HYDROCARBONS													
TRICHLOROBENZENE, 1,2,4-		0.66		2500		30			1300 nc	110	6000	770	540
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500					9900 nc	34	4400	8500	160
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500					3.1 c	0.28	(11) 2900	2900	(1.2) 580
TRICHLOROETHYLENE	0.004		0.004	500		60			140 c	3.9	(14) 130	3900	(0.71) 6.6
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500		10			4700 nc	3.2		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500		10			59 c	0.66	17000	3200	7200
VANADIUM'	5		91	2500	250				910 nc				
VINYL CHLORIDE	0.003		0.003	500		60			0.50 c	0.38	0.25	100	0.0075
XYLENES	0.002		0.002	1000					190000 nc	25	2900	4100	210
ZINC	25		160	2500	800				100000 nc				
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		1.4								
CHLORIDE***	0.25		330										
NITRATE***	5		61										
NITRITE***	5		61										
SODIUM ADSORPTION RATIO (SAR)			2.4		12								
SODIUM***	25												

c Cancer Risk nc Noncancer Risk

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Inorganic mercury criteria used. *** Soil criterion not available.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

('1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATION

FOR MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
ACENAPHTHENE	1.3	MISA	1700	50000	20	Odour			5200	AWQC
ACENAPHTHYLENE	1.4	MISA	2000	50000	310	Noncancer Risk				
ACETONE	0.01	MASS.	500000000	50000	3000	ORSGL	11000000	Volatility Risk	3300	LOEL
ALDRIN	0.01	DW	8.5	50000	0 002	Cancer Risk	1.3	Volatility Risk	30	AWQC
ANTHRACENE	0.01	DW	650	50000	2100	Noncancer Risk			.12	LOEL
ANTIMONY	0.1	DW		50000	6	ORSGL			16000	AWQC
ARSENIC	0.5	DW		50000	25	ODWO			480	AWQC
BARIUM	0.25	DW		50000	1000	ODWO			23000	LOEL
BENZENE	0.5	DW	890000	50000	5	ODWO	(63) 12000	Air Background	53000	AWQC
BENZO(a)ANTHRACENE	0.2	DW	5	50000	0 2	ORSGL			18	LOEL
BENZO(a)PYRENE	[0.01]** 0 05	DW	1.9	50000	0.01	ODWO	3700	Volatility Risk	2.1	LOEL
BENZO(b)FLUORANTHENE	0.1	DW	7	50000	0.2	ORSGL				
BENZO(g,h,i)PERYLENE	0.2	DW	0.13	50000	310	Noncancer Risk			2.0	LOEL
BENZO(k)FLUORANTHENE	0.01	DW	0.4	50000	0.2	ORSGL			74	LOEL
BERYLLIUM	0.25	DW		50000	4	ORSGL			53	AWQC
BIPHENYL, 1,1-	0 6	MISA	3800	50000	350	Noncancer Risk			1700	LOEL
BIS(2-CHLOROETHYL)ETHER	4.4	MISA	5100000	50000	0.03	Cancer Risk	710	Volatility Risk	2400000	AWQC
BIS(2-CHLOROISOPROPYL)ETHER	2.2	MISA	850000	50000	0 5	Cancer Risk	2700	Volatility Risk	2400000	AWQC
BIS(2-ETHYLHEXYL)PHTHALATE	2.2	MISA	650	50000	6	ORSGL	7800000	Volatility Risk	30	AWQC
BORON	10	DW		50000	5000	ODWO				
BROMODICHLOROMETHANE	0 8	MISA	2300000	50000	5	ORSGL			670000	LOEL
BROMOFORM	5	DW	1600000	50000	5	ORSGL	5200	Volatility Risk	290000	LOEL
BROMOMETHANE	3.7	MISA	8800000	50000	10	ORSGL	16	Volatility Risk	3200	LOEL
CADMIUM	0.25	DW		50000	5	ODWO			11	AWQC
CARBON TETRACHLORIDE	2	DW	40000	50000	5	ODWO	(8.8) 100	Air Background	350000	AWQC
CHLORDANE	0 02	DW	28	50000	7	ODWO	170	Volatility Risk	0.04	AWQC
CHLOROANILINE, p-	20	MASS.	1300000	50000	28	Noncancer Risk			100	LOEL
CHLOROBENZENE	0.5	DW	240000	50000	30	ODWO	(2500) 7800	Air Background	500	AWQC
CHLOROFORM	1	DW	4700000	50000	5	ORSGL	(50) 2700	Air Background	12000	AWQC
CHLOROPHENOL, 2-	0.3	DW	14000000	50000	0.18	Odour			44000	AWQC
CHROMIUM (Total)	2 5	DW		50000	50	ODWO			2000	LOEL
CHROMIUM (III)										

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATION

FOR MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
CHROMIUM (VI)	10	DW		50000	**50**	MMCL			110	AWQC
CHRYSENE	**0.5**	DW	3	50000	0.2	ORSGL			7	LOEL
COBALT	0.1	DW		50000					**100**	LOEL
COPPER	2.5	DW		50000	1000	ODWO			**23**	LOEL
CYANIDE	5	DW	500000000	50000	200	ODWO			**52**	AWQC
DIBENZO(a,h)ANTHRACENE	0.1	DW	0 25	50000	**0.2**	ORSGL			150	LOEL
DIBROMOCHLOROMETHANE	2	DW	2000000	50000	**6**	ORSGL			650000	LOEL
DICHLOROBENZENE, 1,2- (o-DCB)	0 5	DW	73000	50000	**3**	ODWO	63000	Volatility Risk	7600	AWQC
DICHLOROBENZENE, 1,3- (m-DCB)	0.5	DW	62000	50000	**630**	Noncancer Risk	63000	Volatility Risk	7600	AWQC
DICHLOROBENZENE, 1,4- (p-DCB)	0.5	DW	40000	50000	**1**	ODWO	180000	Volatility Risk	7600	AWQC
DICHLOROBENZIDINE, 3,3'-	**83**	MASS.	1600	50000	0.08	Cancer Risk			5000	LOEL
DDD	0.08	MISA	80	50000	30	ODWO			**6**	AWQC
DDE	0 08	MISA	**20**	50000	30	ODWO			10000	AWQC
DDT	**0.05**	DW	1.6	50000	30	ODWO	810	Volatility Risk	0.001	AWQC
DICHLOROETHANE, 1,1-	0.5	DW	2800000	50000	**70**	ORSGL	56000	Volatility Risk	2000000	LOEL
DICHLOROETHANE, 1,2-	1	DW	4400000	50000	**5**	ODWO	110	Volatility Risk	200000	AWQC
DICHLOROETHYLENE, 1,1-	0.5	DW	110000	50000	7	MMCL	**4.1**	Volatility Risk	120000	AWQC
DICHLOROETHYLENE, CIS-1,2-	0.5	DW	400000	50000	**70**	MMCL			120000	AWQC
DICHLOROETHYLENE, TRANS-1,2-	0.5	DW	300000	50000	**100**	MMCL			120000	AWQC
DICHLOROPHENOL, 2,4-	0.2	DW	2300000	50000	**0.3**	ODWO			3700	AWQC
DICHLOROPROPANE, 1,2-	0.5	DW	1400000	50000	**5**	MMCL	58	Volatility Risk	57000	AWQC
DICHLOROPROPENE, 1,3-	**1.4**	MISA	1400000	50000	0.5	ORSGL	24	Volatility Risk	2400	AWQC
DIELDRIN	**0.02**	DW	93	50000	0.0022	Cancer Risk	11	Volatility Risk	0 02	AWQC
DIETHYL PHTHALATE	4	MASS.	450000	50000	5600	Noncancer Risk			**30**	AWQC
DIMETHYL PHTHALATE	1.5	MASS.	2500000	50000	7000	Noncancer Risk			**30**	AWQC
DIMETHYLPHENOL, 2,4-	7.3	MISA	3900000	50000	**140**	Noncancer Risk			21000	AWQC
DINITROPHENOL, 2,4-	**42**	MISA	2800000	50000	14	Noncancer Risk			1500	AWQC
DINITROTOLUENE, 2,4-	**0.5**	DW	140000	50000	0 05	Cancer Risk			2300	AWQC
DIOXIN / FURAN (TEQ)	0.000004	DW		50000	**0.000015**	ODWO				
ENDOSULFAN	0.12	MASS.	75	50000	**0.35**	Noncancer Risk			0.56	AWQC
ENDRIN	**0.05**	DW	130	50000	2	MMCL			0.02	AWQC
ETHYLBENZENE	0.5	DW	81000	50000	**2.4**	ODWO	180000	Volatility Risk	320000	AWQC

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATION

FOR MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
ETHYLENE DIBROMIDE	1	DW	2200000	50000	0.00041	Cancer Risk	21	Volatility Risk	28000	LOEL
FLUORANTHENE	0.2	DW	130	50000	280	Noncancer Risk			40000	AWQC
FLUORENE	1.7	DW	950	50000	280	Noncancer Risk			290	LOEL
HEPTACHLOR	0.01	DW	28	50000	3	ODWO	1.6	Volatility Risk	0.04	AWQC
HEPTACHLOR EPOXIDE	0.01	DW	180	50000	3	ODWO	37	Volatility Risk		
HEXACHLOROBENZENE	0.01	DW	55	50000	1	ORSGL	3.9	Volatility Risk	37	AWQC
HEXACHLOROBUTADIENE	0.01	DW	1000	50000	0.45	Cancer Risk	5.4	Volatility Risk	93	AWQC
HEXACHLOROCYCLOHEXANE, GAMMA	0.01	DW	3500	50000	4	ODWO			0.8	AWQC
HEXACHLOROETHANE	0.01	DW	25000	50000	2.8	Cancer Risk	78	Volatility Risk	5400	AWQC
INDENO(1,2,3-cd)PYRENE	0.2	DW	0.27	50000	0.0048	Cancer Risk				
LEAD	0.25	DW		50000	10	ODWO			32	AWQC
MERCURY	0.02	DW	28	50000	1	ODWO			0.12	AWQC
METHOXYCHLOR	0.05	DW	20	50000	900	ODWO			0.3	AWQC
METHYL ETHYL KETONE	100	MASS.	140000000	50000	350	ORSGL	11000000	Volatility Risk	1200000	LOEL
METHYL ISOBUTYL KETONE	50	MASS.	9600000	50000	350	ORSGL	350000	Volatility Risk	4300000	LOEL
METHYL MERCURY				50000	2.1	Noncancer Risk			0.12	AWQC
METHYL TERT BUTYL ETHER	0.5	MASS	24000000	50000	700	ORSGL	520000	Volatility Risk	1000000	LOEL
METHYLENE CHLORIDE	5	DW	8400000	50000	50	ODWO	570000	Volatility Risk	130000	LOEL
METHYLNAPHTHALENE, 2-	2.2	MISA	13000	50000	10	Odour	150000	Volatility Risk	15000	AWQC
MOLYBDENUM	0.25	DW		50000					7300	LOEL
NAPHTHALENE	1.6	MISA	16000	50000	21	Odour	37000	Volatility Risk	6200	AWQC
NICKEL	1	DW		50000	100	ORSGL			1600	LOEL
PENTACHLOROPHENOL	0.1	DW	7000	50000	30	ODWO	15000	Volatility Risk	130	LOEL
PETROLEUM HYDROCARBONS (gasoline/diesel)					1000	Mass. Ceiling *				
PETROLEUM HYDROCARBONS (heavy oils)					1000	Mass. Ceiling *				
PHENANTHRENE	0.1	DW	410	50000	310	Noncancer Risk			63	AWQC
PHENOL	2.4	MISA	40000000	50000	4200	Noncancer Risk	120000000	Volatility Risk	26000	AWQC
POLYCHLORINATED BIPHENYLS	0.2	DW	16	50000	3	ODWO	6.1	Volatility Risk	0.15	AWQC
PYRENE	0.2	DW	80	50000	210	Noncancer Risk			40	LOEL
SELENIUM	5	DW		50000	10	ODWO			50	AWQC
SILVER	0.25	DW		50000	35	Noncancer Risk			1.2	AWQC
STYRENE	0.5	DW	150000	50000	100	MMCL	(2500) 5900	Air Background		

TABLE A: COMPONENTS FOR MOEE POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATION

FOR MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MOEE MDL Value	MDL Basis	Solubility (1/2)	Ceiling Value	GW1	Basis	GW2	Basis	GW3	Basis
TETRACHLOROETHANE, 1,1,1,2-	5	MASS	100000	50000	1.4	Cancer Risk	38	Volatility Risk	93000	AWQC
TETRACHLOROETHANE, 1,1,2,2-	1	DW	1500000	50000	0.18	Cancer Risk	140	Volatility Risk	24000	AWQC
TETRACHLOROETHYLENE	0.5	DW	100000	50000	5	MMCL	(3100) 16000	Air Background	8400	AWQC
THALLIUM	0.25	DW		50000	2	ORSGL			400	AWQC
TOLUENE	0.5	DW	270000	50000	24	ODWO	37000	Volatility Risk	180000	AWQC
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-	0.05	DW	9500	50000	70	ORSGL	3900	Volatility Risk	500	AWQC
TRICHLOROETHANE, 1,1,1-	0.5	DW	370000	50000	200	MMCL	26000	Volatility Risk	180000	AWQC
TRICHLOROETHANE, 1,1,2-	0.6	DW	2300000	50000	5	ORSGL	(190) 100000	Air Background	94000	AWQC
TRICHLOROETHYLENE	0.5	DW	550000	50000	50	ODWO	(190) 1700	Air Background	220000	AWQC
TRICHLOROPHENOL, 2,4,5-	0.6	DW	600000	50000	200	Odour			630	AWQC
TRICHLOROPHENOL 2,4,6-	0.2	DW	400000	50000	2	ODWO	230000	Volatility Risk	9700	AWQC
VANADIUM	0.25	DW		50000					200	LOEL
VINYL CHLORIDE	0.5	DW	550	50000	2	ODWO	1.3	Volatility Risk	3600000	AWQC
XYLENES	1.1	DW	85000	50000	300	ODWO	35000	Volatility Risk		
ZINC	1	DW		50000	5000	ODWO			1100	LOEL
ELECTRICAL CONDUCTIVITY (mS/cm)	0.005	DW								
CHLORIDE	2000	MISA			250000	ODWO				
NITRATE	250	MISA		50000	10000	ODWO				
NITRITE	250	MISA		50000	1000	ODWO			2000	LOEL
SODIUM ADSORPTION RATIO (SAR)										
SODIUM	50	MISA			200000	ODWO				

( ) Volatility risk value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

[ ]** MDL currently above ODWO

* Massachusetts set a GW1 ceiling value of 1000 ug/L for TPH.

Appendix A.2.6: Table B Criteria Components - Medium/Fine Textured Soil (Surface/Full Depth) - Non-Potable Groundwater Situation

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS												
MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	1000					1400 nc		1300	
ACENAPHTHYLENE	0.05		0.08	100					1000 nc		840	
ACETONE		0.1		500					3400 nc	58	3.8	12000
ALDRIN	0.05		0.05	1000		0.35			0.026 c	11	69	0.93
ANTHRACENE	0.05		0.16	1000		40			5300 nc		28	
ANTIMONY	1		1	1000	25				13 nc			
ARSENIC	1		17	1000	25							
BARIUM'	2.5		210	1000	1000				3700 nc			
BENZENE	0.002		0.002	500		25			35 c	(3.0) 580	2400	(0.19) 33
BENZO(a)ANTHRACENE	0.05		0.74	1000		40	120	Shl/Tex			170	
BENZO(a)PYRENE	0.05		0.49	1000		40	1.2	Shl/Tex		1700	1700	300000
BENZO(b)FLUORANTHENE	0.05		0.47	1000			12	Shl/Tex			640	
BENZO(g,h,i)PERYLENE	0.1		0.68	1000		40	120	Shl/Tex			53	
BENZO(k)FLUORANTHENE	0.05		0.48	1000		40	12	Shl/Tex			37	
BERYLLIUM	0.5		1.2	1000	5				0.37 c			
BIPHENYL, 1,1-		0.05		1000					1900 nc		4.3	
BIS(2-CHLOROETHYL)ETHER		0.66		500					0.12 c	1.5	110	0.81
BIS(2-CHLOROISOPROPYL)ETHER		0.66		500					1.9 c	29	540	5.1
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		1000					130 c	11000	500	1000000
BORON (Available)'					1.5							
BROMODICHLOROMETHANE		0.005		100					14 c		1200	
BROMOFORM	0.002		0.002	500					110 c	120	1100	14
BROMOMETHANE	0.003		0.003	500					47 nc	20	3900	0.38
CADMIUM	1		1	1000		12			14 nc			
CARBON TETRACHLORIDE	0.002		0.002	500					6.8 c	(1.8) 20	1000	(0.044) 0.64
CHLORDANE	0.05		0.05	1000					0.99 c	200	0.29	110
CHLOROANILINE, p-		1.3		100					130 nc		1.1	
CHLOROBENZENE	0.002		0.002	500		30			670 nc	(200) 620	40	(20) 50
CHLOROFORM	0.002		0.006	500					140 c	(1.3) 71	330	(0.069) 4.9
CHLOROPHENOL, 2-	0.1		0.1	1000		10			95 nc		800	
CHROMIUM (Total)	5		71	1000	1000							

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		1000		230			47000 nc			
CHROMIUM (VI)	2.5		2.5	1000	10				180 nc			
CHRYSENE	0.05		0.69	1000		40	12	Shl/Tex			100	
COBALT'	2.5		21	1000	80				2700 nc			
COPPER'	5		85	1000	300				1100 nc			
CYANIDE (Free)	0.05		0.12	100					100 nc		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	1000			1.2	Shl/Tex			140	
DIBROMOCHLOROMETHANE	0.003		0.003	100					10 c		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	100		30			3000 nc	15000	2300	1700
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	100		30			3000 nc	15000	2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	500		30			37 c	13000	2400	5200
DICHLOROBENZIDINE, 3,3'-		1.3		1000					0.51 c		400	
DDD	0.05			1000					2.2 c		780	
DDE	0.01			1000		4			1.6 c		15000	
DDT	0.05		1.4	1000		4			1.6 c	64	2.0	2900
DICHLOROETHANE, 1,1-	0.002		0.002	100					2600 nc	2200	2200	140
DICHLOROETHANE, 1,2-	0.002		0.002	500		60			9.6 c	1.0	460	0.14
DICHLOROETHYLENE, 1,1-	0.002		0.002	500					1.4 c	0.42	5200	0.015
DICHLOROETHYLENE, CIS-1,2-		0.005		100			2.3	Table A'	340 nc		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	500			4.1	Table A'	670 nc		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	100		10			41 nc		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	100					7.9 c	1.5	1300	0.12
DICHLOROPROPENE, 1,3-	0.003		0.003	500					3.0 c	0.62	63	0.041
DIELDRIN	0.05		0.05	1000		4			0.028 c	14	0.025	1.3
DIETHYL PHTHALATE		0.66		1000					44000 nc		0.71	
DIMETHYL PHTHALATE		0.66		1000					39000 nc		0.7	
DIMETHYLPHENOL, 2,4-	0.2		0.2	1000					380 nc		140	
DINITROPHENOL, 2,4-	0.2		0.2	1000					38 nc		4.1	
DINITROTOLUENE, 2,4-		0.66		1000					1.1 c		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				1	CCME				
ENDOSULFAN	0.04	0.009		1000					140 nc		0.29	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	1000		0.06			5.9 nc		0.014	
ETHYLBENZENE	0.002		0.002	600					2300 nc	5800	5800	1800
ETHYLENE DIBROMIDE	0.004		0.004	100					0.01 c	0.24	320	0.035
FLUORANTHENE	0.05		1.1	1000		40			910 nc		840	
FLUORENE	0.05		0.12	1000					910 nc		350	
HEPTACHLOR	0.05		0.05	1000					0.12 c	5.8	0.15	0.53
HEPTACHLOR EPOXIDE	0.05		0.05	1000					0.06 c	140	680	13
HEXACHLOROBENZENE	0.01			1000		30			0.46 c	780	7300	71
HEXACHLOROBUTADIENE	0.01			100					6.9 c	27	460	2.4
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			1000		2			0.41 c		0.49	
HEXACHLOROETHANE	0.01			100					6.3 nc	260	1800	24
INDENO(1,2,3-cd)PYRENE	0.1		0.38	1000		40	12	Shl/Tex			70	
LEAD	10		120	1000			200	MOEE 1				
MERCURY	0.05		0.23	1000		10			13 nc			
METHOXYCHLOR	0.05		0.05	1000					110 nc		4.0	
METHYL ETHYL KETONE		0.1		500					20000 nc	38	38	11000
METHYL ISOBUTYL KETONE		0.05		100					1700 nc	69	69	360
METHYL MERCURY				1000		10			6.8 nc			
METHYL TERT BUTYL ETHER		0.05		100					170 nc	410	410	740
METHYLENE CHLORIDE	0.003		0.003	500					120 c	1100	1100	840
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	1000					1300 nc	1600	1600	1800
MOLYBDENUM'	2.5		2.5	1000	40				170 nc			
NAPHTHALENE	0.05		0.09	100		40			1300 nc	3500	1400	760
NICKEL	2.5		43	1000	200				310 nc			
PENTACHLOROPHENOL	0.1		0.1	1000		5			6.9 c	37000	680	7300
PETROLEUM HYDROCARBONS (gasoline/diesel)							1000	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)							1000	MOEE 2				
PHENANTHRENE	0.05		0.69	1000		40	120	Shl/Tex			150	
PHENOL	0.1		0.1	500		40			11000 nc	760	390	290000
POLYCHLORINATED BIPHENYLS	0.3		0.3				5	CCME				
PYRENE	0.05		1	1000					680 nc		250	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S1 Risk	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	1000	10				320 nc			
SILVER	0.25		0.42	1000	25				98 nc			
STYRENE	0.002		0.002	500					18 c	(42) 99	840	(2.8) 7.7
TETRACHLOROETHANE, 1,1,1,2-		0.005		100					3.6 c	2.9	3900	0.12
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	500					0.47 c	1.4	240	0.23
TETRACHLOROETHYLENE	0.002		0.002	500		60	0.45	Table A^a^	170 c	(280) 1500	760	(24) 140
THALLIUM	2.5		2.5	1000					4.1 nc			
TOLUENE	0.002		0.002	500		150			8100 nc	3200	4300	210
TPH - refer to PETROLEUM HYDROCARBONS												
TRICHLOROBENZENE, 1,2,4-		0.66		1000		30			370 nc	6000	770	540
TRICHLOROETHANE, 1,1,1-	0.002		0.009	100			34	Table A^a^	3000 nc	4400	8500	160
TRICHLOROETHANE, 1,1,2-	0.002		0.002	100					2.3 c	(11) 2900	2900	(1.2) 560
TRICHLOROETHYLENE	0.004		0.004	100		60	3.9	Table A^a^	67 nc	(14) 130	3900	(0.71) 6.6
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	1000		10			1900 nc		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	1000		10			39 c	17000	3200	7200
VANADIUM*	5		91	1000	250				470 nc			
VINYL CHLORIDE	0.003		0.003	100		60			0.29 c	0.25	100	0.0075
XYLENES	0.002		0.002	500					61000 nc	2900	4100	210
ZINC	25		160	1000	800				16000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		0.7							
CHLORIDE**	0.25		330									
NITRATE**	5		61									
NITRITE**	5		61									
SODIUM ADSORPTION RATIO (SAR)			2.4		5							
SODIUM**	25											

c Cancer Risk nc Noncancer Risk

+ S-1 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff. ** Soil criterion not available.

a Soil criterion from Table A (potable groundwater situation) adopted to account for degradation to vinyl chloride.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
ACENAPHTHENE	0.05		0.07	2500					3600 nc		1300	
ACENAPHTHYLENE	0.05		0.08	2500					2700 nc		840	
ACETONE		0.1		1000					11000 nc	58	3.8	12000
ALDRIN	0.05		0.05	2500		0.35			0.04 c	11	69	0.93
ANTHRACENE	0.05		0.16	2500		40			13000 nc		28	
ANTIMONY	1		1	2500	50				44 nc			
ARSENIC	1		17	2500	50							
BARIUM'	2.5		210	2500	2000				8700 nc			
BENZENE	0.002		0.002	1000		25			63 c	(3.0) 580	2400	(0.19) 33
BENZO(a)ANTHRACENE	0.05		0.74	2500		40	190	Shl/Tex			170	
BENZO(a)PYRENE	0.05		0.49	2500		40	1.9	Shl/Tex		1700	1700	300000
BENZO(b)FLUORANTHENE	0.05		0.47	2500			19	Shl/Tex			640	
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		40	190	Shl/Tex			53	
BENZO(k)FLUORANTHENE	0.05		0.48	2500		40	19	Shl/Tex			37	
BERYLLIUM	0.5		1.2	2500	10				0.85 c			
BIPHENYL, 1,1-		0.05		2500					6600 nc		4.3	
BIS(2-CHLOROETHYL)ETHER		0.66		1000					0.16 c	1.5	110	0.81
BIS(2-CHLOROISOPROPYL)ETHER		0.66		1000					2.6 c	29	540	5.1
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500					330 c	11000	500	1000000
BORON (Available)'					2							
BROMODICHLOROMETHANE		0.005		500					25 c		1200	
BROMOFORM	0.002		0.002	1000					190 c	120	1100	14
BROMOMETHANE	0.003		0.003	1000					150 nc	20	3900	0.38
CADMIUM	1		1	2500		12			41 nc			
CARBON TETRACHLORIDE	0.002		0.002	1000					12 c	(1.8) 20	10000	(0.044) 0.64
CHLORDANE	0.05		0.05	2500					2.0 c	200	0.29	110
CHLOROANILINE, p-		1.3		2500					440 nc		1.1	
CHLOROBENZENE	0.002		0.002	1000		30			2200 nc	(200) 620	40	(20) 50
CHLOROFORM	0.002		0.006	1000					250 c	(1.3) 71	330	(0.069) 4.9
CHLOROPHENOL, 2-	0.1		0.1	2500		10			240 nc		800	
CHROMIUM (Total)	5		71	2500	1000							

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
CHROMIUM (III)		1.4		2500		230			220000 nc			
CHROMIUM (VI)	2.5		2.5	2500	10				600 nc			
CHRYSENE	0.05		0.69	2500		40	19	Shl/Tex			100	
COBALT'	2.5		21	2500	100				7200 nc			
COPPER'	5		85	2500	300				3400 nc			
CYANIDE (Free)	0.05		0.12	500					100 nc		610000	
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500			1.9	Shl/Tex			140	
DIBROMOCHLOROMETHANE	0.003		0.003	500					18 c		930	
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500		30			9900 nc	15000	2300	1700
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500		30			9900 nc	15000	2300	
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000		30			63 c	13000	2400	5200
DICHLOROBENZIDINE, 3,3'-		1.3		2500					0.72 c		400	
DDD	0.05			2500					3.5 c		780	
DDE	0.01			2500		4			2.4 c		15000	
DDT	0.05		1.4	2500		4			2.4 c	64	2.0	2900
DICHLOROETHANE, 1,1-	0.002		0.002	500					8500 nc	2200	2200	140
DICHLOROETHANE, 1,2-	0.002		0.002	1000		60			17 c	1.0	460	0.14
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000					2.5 c	0.42	5200	0.015
DICHLOROETHYLENE, CIS-1,2-		0.005		500			2.3	Table A'	1100 nc		1700	
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000			4.1	Table A'	2200 nc		2100	
DICHLOROPHENOL, 2,4-	0.01		0.1	2500		10			94 nc		3700	
DICHLOROPROPANE, 1,2-	0.002		0.002	500					12 c	1.5	1300	0.12
DICHLOROPROPENE, 1,3-	0.003		0.003	1000					4.6 c	0.62	63	0.041
DIELDRIN	0.05		0.05	2500		4			0.04 c	14	0.025	1.3
DIETHYL PHTHALATE		0.66		2500					270000 nc		0.71	
DIMETHYL PHTHALATE		0.66		2500					150000 nc		0.7	
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500					940 nc		140	
DINITROPHENOL, 2,4-	0.2		0.2	2500					94 nc		4.1	
DINITROTOLUENE, 2,4-		0.66		2500					1.8 c		17	
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007				1	CCME				
ENDOSULFAN	0.04			2500					360 nc		0.29	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
ENDRIN	0.05		0.05	2500		0.06			15 nc		0.014	
ETHYLBENZENE	0.002		0.002	1000					6000 nc	5800	5800	1800
ETHYLENE DIBROMIDE	0.004		0.004	500					0.02 c	0.24	320	0.035
FLUORANTHENE	0.05		1.1	2500		40			2400 nc		840	
FLUORENE	0.05		0.12	2500					2400 nc		350	
HEPTACHLOR	0.05		0.05	2500					0.18 c	5.8	0.15	0.53
HEPTACHLOR EPOXIDE	0.05		0.05	2500					0.09 c	140	680	13
HEXACHLOROBENZENE	0.01			2500		30			0.76 c	780	7300	71
HEXACHLOROBUTADIENE	0.01			2500					11 c	27	460	2.4
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500		2			0.64 c		0.49	
HEXACHLOROETHANE	0.01			2500					13 c	260	1800	24
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		40	19	Sh/Tex			70	
LEAD	10		120	2500			1000	MOEE 1				
MERCURY	0.05		0.23	2500		10			57 nc			
METHOXYCHLOR	0.05		0.05	2500					300 nc		4.0	
METHYL ETHYL KETONE		0.1		1000					66000 nc	38	38	11000
METHYL ISOBUTYL KETONE		0.05		500					5500 nc	69	69	360
METHYL MERCURY **				2500		10			18 nc			
METHYL TERT BUTYL ETHER		0.05		500					570 nc	410	410	740
METHYLENE CHLORIDE	0.003		0.003	1000					200 c	1100	1100	840
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	2500					4400 nc	1600	1600	1800
MOLYBDENUM*	2.5		2.5	2500	40				550 nc			
NAPHTHALENE	0.05		0.09	2500		40			4400 nc	3500	1400	760
NICKEL	2.5		43	2500	200				710 nc			
PENTACHLOROPHENOL	0.1		0.1	2500		5			12 c	37000	680	7300
PETROLEUM HYDROCARBONS (gasoline/diesel)							2000	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)							5000	MOEE 2				
PHENANTHRENE	0.05		0.69	2500		40	190	Sh/Tex			150	
PHENOL	0.1		0.1	1000		40			28000 nc	760	390	290000
POLYCHLORINATED BIPHENYLS	0.3		0.3				25	CCME				
PYRENE	0.05		1	2500					1800 nc		250	

TABLE B: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SURFACE/FULL DEPTH) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS												
MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)											
	MOEE	MASS.	ONT Soil	Ceiling	Ecotoxicity Criteria		Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		Soil/Ind Air
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	MOEE	Neth. C	Value	Basis	S2 Risk	S-/GW2	S-/GW3	S/IA
SELENIUM	1		1.9	2500	10				3100 nc			
SILVER	0.25		0.42	2500	50				240 nc			
STYRENE	0.002		0.002	1000					28 c	(42) 99	840	(2.8) 7.7
TETRACHLOROETHANE, 1,1,1,2-		0.005		500					4.9 c	2.9	3900	0.12
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000					0.64 c	1.4	240	0.23
TETRACHLOROETHYLENE	0.002		0.002	1000		60	0.45	Table A*	290 c	(280) 1500	760	(24) 140
THALLIUM	2.5		2.5	2500					32 nc			
TOLUENE	0.002		0.002	1000		150			1900 nc	3200	4300	210
TPH - refer to PETROLEUM HYDROCARBONS												
TRICHLOROBENZENE, 1,2,4-		0.66		2500		30			1300 nc	6000	770	540
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500			34	Table A*	9900 nc	4400	8500	160
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500					3.1 nc	(11) 2900	2900	(1.2) 580
TRICHLOROETHYLENE	0.004		0.004	500		60	3.9	Table A*	140 c	(14) 130	3900	(0.71) 6.6
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500		10			4700 nc		10	
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500		10			59 c	17000	3200	7200
VANADIUM*	5		91	2500	250				910 nc			
VINYL CHLORIDE	0.003		0.003	500		60			0.50 c	0.25	100	0.0075
XYLENES	0.002		0.002	1000					190000 nc	2900	4100	210
ZINC	25		160	2500	600				100000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm)	0.25		0.57		1.4							
CHLORIDE***	0.25		330									
NITRATE***	5		61									
NITRITE***	5		61									
SODIUM ADSORPTION RATIO (SAR)			24		12							
SODIUM***	25											

c Cancer Risk nc Noncancer Risk

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach ** Inorganic mercury criteria used. *** Soil criterion not available.

a Soil criterion from Table A (potable groundwater situation) adopted to account for degradation to vinyl chloride.

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATIONS

MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MDL Value	Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
ACENAPHTHENE	1.3	MISA	**1700**	50000			5200	AWQC		
ACENAPHTHYLENE	1.4	MISA	**2000**	50000						
ACETONE	0.01	MASS.	500000000	50000	11000000	Volatility Risk	**3300**	LOEL		
ALDRIN	0.01	DW	8.5	50000	**1.3**	Volatility Risk	30	AWQC		
ANTHRACENE	0.01	DW	650	50000			**12**	LOEL		
ANTIMONY	0.1	DW		50000			**16000**	AWQC		
ARSENIC	0.5	DW		50000			**480**	AWQC		
BARIUM	0.25	DW		50000			**23000**	LOEL		
BENZENE	0.5	DW	890000	50000	**(83). 12000**	Air Background	53000	AWQC		
BENZO(a)ANTHRACENE	0.2	DW	**8**	50000			18	LOEL		
BENZO(a)PYRENE	0.05	DW	**1.9**	50000	3700	Volatility Risk	2.1	LOEL		
BENZO(b)FLUORANTHENE	0.1	DW	**7**	50000						
BENZO(g,h,i)PERYLENE	**0.2**	DW	0.13	50000			2.0	LOEL		
BENZO(k)FLUORANTHENE	0.01	DW	**0.4**	50000			74	LOEL		
BERYLLIUM	0.25	DW		50000			**53**	AWQC		
BIPHENYL, 1,1-	0.6	MISA	3800	50000			**1700**	LOEL		
BIS(2-CHLOROETHYL)ETHER	4.4	MISA	5100000	50000	**710**	Volatility Risk	2400000	AWQC		
BIS(2-CHLOROISOPROPYL)ETHER	2.2	MISA	850000	50000	**2700**	Volatility Risk	2400000	AWQC		
BIS(2-ETHYLHEXYL)PHTHALATE	2.2	MISA	650	50000	7800000	Volatility Risk	**30**	AWQC		
BORON	10	DW		**50000**						
BROMODICHLOROMETHANE	0.8	MISA	2300000	**50000**			670000	LOEL		
BROMOFORM	5	DW	1600000	50000	**5200**	Volatility Risk	290000	LOEL		
BROMOMETHANE	3.7	MISA	8800000	50000	**16**	Volatility Risk	3200	LOEL		
CADMIUM	0.25	DW		50000			**11**	AWQC		
CARBON TETRACHLORIDE	2	DW	40000	50000	**(8.8) . 100**	Air Background	350000	AWQC		
CHLORDANE	0.02	DW	28	50000	170	Volatility Risk	**0.04**	AWQC		
CHLOROANILINE, p-	20	MASS.	1300000	50000			**100**	LOEL		
CHLOROBENZENE	0.5	DW	240000	50000	(2500) 7800	Air Background	**500**	AWQC		
CHLOROFORM	1	DW	470000	50000	**(50) . 2700**	Air Background	12000	AWQC		
CHLOROPHENOL, 2-	0.3	DW	14000000	50000			**44000**	AWQC		
CHROMIUM (Total)	2.5	DW		50000			**2000**	LOEL		
CHROMIUM (III)										

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATIONS

MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MDL Value	Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
CHROMIUM (VI)	10	DW		50000			110	AWQC		
CHRYSENE	0.5	DW	3	50000			7	LOEL		
COBALT	0.1	DW		50000			100	LOEL		
COPPER	2.5	DW		50000			23	LOEL		
CYANIDE	5	DW	500000000	50000			52	AWQC		
DIBENZO(a,h)ANTHRACENE	0.1	DW	0.25	50000			150	LOEL		
DIBROMOCHLOROMETHANE	2	DW	2000000	50000			650000	LOEL		
DICHLOROBENZENE, 1,2- (o-DCB)	0.5	DW	73000	50000	63000	Volatility Risk	7600	AWQC		
DICHLOROBENZENE, 1,3- (m-DCB)	0.5	DW	62000	50000	63000	Volatility Risk	7600	AWQC		
DICHLOROBENZENE, 1,4- (p-DCB)	0.5	DW	40000	50000	180000	Volatility Risk	7600	AWQC		
DICHLOROBENZIDINE, 3,3'-	83	MASS.	1600	50000			5000	LOEL		
DDD	0.08	MISA	80	50000			6	AWQC		
DDE	0.08	MISA	20	50000			10000	AWQC		
DDT	0.05	DW	1.6	50000	810	Volatility Risk	0.001	AWQC		
DICHLOROETHANE, 1,1-	0.5	DW	2800000	50000	56000	Volatility Risk	2000000	LOEL		
DICHLOROETHANE, 1,2-	1	DW	4400000	50000	110	Volatility Risk	200000	AWQC		
DICHLOROETHYLENE, 1,1-	0.5	DW	110000	50000	4.1	Volatility Risk	120000	AWQC		
DICHLOROETHYLENE, CIS-1,2-	0.5	DW	400000	50000			120000	AWQC	70	MMCL
DICHLOROETHYLENE, TRANS-1,2-	0.5	DW	300000	50000			120000	AWQC	100	MMCL
DICHLOROPHENOL, 2,4-	0.2	DW	2300000	50000			3700	AWQC		
DICHLOROPROPANE, 1,2-	0.5	DW	1400000	50000	58	Volatility Risk	57000	AWQC		
DICHLOROPROPENE, 1,3-	1.4	MISA	1400000	50000	24	Volatility Risk	2400	AWQC		
DIELDRIN	0.02	DW	83	50000	11	Volatility Risk	0.02	AWQC		
DIETHYL PHTHALATE	4	MASS.	450000	50000			30	AWQC		
DIMETHYL PHTHALATE	1.5	MASS.	2500000	50000			30	AWQC		
DIMETHYLPHENOL, 2,4-	7.3	MISA	3900000	50000			21000	AWQC		
DINITROPHENOL, 2,4-	42	MISA	2800000	50000			1500	AWQC		
DINITROTOLUENE, 2,4-	0.5	DW	140000	50000			2300	AWQC		
DIOXIN / FURAN (TEQ)	0.000004	DW					0.000015	ODWO **		
ENDOSULFAN	0.12	MASS.	75	50000			0.56	AWQC		
ENDRIN	0.05	DW	130	50000			0.02	AWQC		
ETHYLBENZENE	0.5	DW	81000	50000	180000	Volatility Risk	320000	AWQC		

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATIONS

MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MDL Value	Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos *	Basis
ETHYLENE DIBROMIDE	1	DW	2200000	50000	21	Volatility Risk	28000	LOEL		
FLUORANTHENE	0.2	DW	130	50000			40000	AWQC		
FLUORENE	1.7	DW	950	50000			290	LOEL		
HEPTACHLOR	0.01	DW	28	50000	1.6	Volatility Risk	0.04	AWQC		
HEPTACHLOR EPOXIDE	0.01	DW	180	50000	37	Volatility Risk				
HEXACHLOROBENZENE	0.01	DW	55	50000	3.9	Volatility Risk	37	AWQC		
HEXACHLOROBUTADIENE	0.01	DW	1000	50000	5.4	Volatility Risk	93	AWQC		
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	0.5	MASS.	3500	50000			0.8	AWQC		
HEXACHLOROETHANE	0.01	DW	25000	50000	78	Volatility Risk	5400	AWQC		
INDENO(1,2,3-cd)PYRENE	0.2	DW	0.27	50000						
LEAD	0.25	DW		50000			32	AWQC		
MERCURY	0.02	DW	28	50000			0.12	AWQC		
METHOXYCHLOR	0.05	DW	20	50000			0.3	AWQC		
METHYL ETHYL KETONE	100	MASS.	140000000	50000	11000000	Volatility Risk	1200000	LOEL		
METHYL ISOBUTYL KETONE	50	MASS.	9600000	50000	350000	Volatility Risk	4300000	LOEL		
METHYL MERCURY				50000			0.12	AWQC		
METHYL TERT BUTYL ETHER	0.5	MASS	24000000	50000	520000	Volatility Risk	1000000	LOEL		
METHYLENE CHLORIDE	5	DW	8400000	50000	570000	Volatility Risk	130000	LOEL		
METHYLNAPHTHALENE, 2-	2.2	MISA	13000	50000	150000	Volatility Risk	15000	AWQC		
MOLYBDENUM	0.25	DW		50000			7300	LOEL		
NAPHTHALENE	1.6	MISA	16000	50000	37000	Volatility Risk	6200	AWQC		
NICKEL	1	DW		50000			1600	LOEL		
PENTACHLOROPHENOL	0.1	DW	7000	50000	15000	Volatility Risk	130	LOEL		
PETROLEUM HYDROCARBONS (gasoline/diesel)										
PETROLEUM HYDROCARBONS (heavy oils)										
PHENANTHRENE	0.1	DW	410	50000			63	AWQC		
PHENOL	2.4	MISA	40000000	50000	120000000	Volatility Risk	26000	AWQC		
POLYCHLORINATED BIPHENYLS	0.2	DW	16	50000	6.1	Volatility Risk	0.15	AWQC		
PYRENE	0.2	DW	80	50000			40	LOEL		
SELENIUM	5	DW		50000			50	AWQC		
SILVER	0.25	DW		50000			1.2	AWQC		
STYRENE	0.5	DW	150000	50000	(2500) 5900	Air Background				

TABLE B: COMPONENTS FOR MOEE NON-POTABLE GROUNDWATER CRITERIA - FOR MEDIUM/FINE TEXTURED SOIL SITUATIONS

MEDIUM/FINE TEXTURED SOIL SITUATION	ALL CATEGORIES (Agricultural, Residential/Parkland, Industrial/Commercial) (ug/L)									
CHEMICAL PARAMETER	MDL Value	Basis	Solubility (1/2)	Ceiling Value	GW2	Basis	GW3	Basis	Substitute Nos.*	Basis
TETRACHLOROETHANE, 1,1,1,2-	5	MASS	100000	50000	38	Volatility Risk	93000	AWQC		
TETRACHLOROETHANE, 1,1,2,2-	1	DW	1500000	50000	140	Volatility Risk	24000	AWQC		
TETRACHLOROETHYLENE	0.5	DW	100000	50000	(3100) 16000	Air Background	8400	AWQC	5	MMCL
THALLIUM	0.25	DW		50000			400	AWQC		
TOLUENE	0.5	DW	270000	50000	37000	Volatility Risk	180000	AWQC		
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-	0.05	DW	9500	50000	3900	Volatility Risk	500	AWQC		
TRICHLOROETHANE, 1,1,1-	0.5	DW	370000	50000	26000	Volatility Risk	180000	AWQC	200	MMCL
TRICHLOROETHANE, 1,1,2-	0.6	DW	2300000	50000	(190) 100000	Air Background	94000	AWQC		
TRICHLOROETHYLENE	0.5	DW	550000	50000	(190) 1700	Air Background	220000	AWQC	50	ODWO
TRICHLOROPHENOL, 2,4,5-	0.6	DW	800000	50000			630	AWQC		
TRICHLOROPHENOL 2,4,6-	0.2	DW	400000	50000	230000	Volatility Risk	9700	AWQC		
VANADIUM	0.25	DW		50000			200	LOEL		
VINYL CHLORIDE	0.5	DW	550	50000	1.3	Volatility Risk	3600000	AWQC		
XYLENES	1.1	DW	85000	50000	35000	Volatility Risk				
ZINC	1	DW		50000			1100	LOEL		
ELECTRICAL CONDUCTIVITY (mS/cm)	0.005	DW								
CHLORIDE	2000	MISA								
NITRATE	250	MISA		50000						
NITRITE	250	MISA		50000			2000	LOEL		
SODIUM ADSORPTION RATIO (SAR)										
SODIUM	50	MISA								

( ) Volatility risk value in brackets is based on meeting the indoor air cancer risk concenration which is below the indoor air background concentration used in the Mass. approach.

* Groundwater criterion from Table A (potable groundwater) adopted to account for degradation to vinyl chloride.

** ODWO used due to unavailability of a LOEL for total Dioxins/Furans (TEQ)

Appendix A.2.7: Table C Criteria Components - Medium/Fine Textured Soil (Sub-surface) - Potable Groundwater Situation

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
ACENAPHTHENE	0 05		0.07	2500				3600 nc	**15**		1300
ACENAPHTHYLENE	0.05		0.08	2500				2700 nc	**130**		840
ACETONE		0.1		1000				11000 nc	**3.5**	58	3 8
ALDRIN	**0.05**		0.05	2500				0.04 c	0 08	11	69
ANTHRACENE	0.05		0.16	2500				13000 nc	1500		**28**
ANTIMONY	1		1	2500				**44** nc			
ARSENIC	1		17	2500	**50**						
BARIUM'	2.5		210	**2500**				8700 nc			
BENZENE	0.002		0.002	1000				63 c	**0.24**	(3 0) 580	2400
BENZO(a)ANTHRACENE	0.05		0.74	2500		190	Shl/Tex		**6.6**		170
BENZO(a)PYRENE	0.05		0.49	2500		**1.9**	Shl/Tex		9.0	1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	2500		19	Shl/Tex		**18**		640
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		190	Shl/Tex		**53**		**53**
BENZO(k)FLUORANTHENE	0 05		0.48	2500		19	Shl/Tex		**18**		37
BERYLLIUM	0.5		**1.2**	2500				0.85 c			
BIPHENYL, 1,1-		0.05		2500				6600 nc	**0.89**		4.3
BIS(2-CHLOROETHYL)ETHER		**0.66**		1000				0.16 c	0.01	1.5	110
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		1000				2.6 c	0 024	29	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500				330 c	**100**	11000	500
BORON (Available)'					**2**						
BROMODICHLOROMETHANE		0.005		500				25 c	**0.12**		1200
BROMOFORM	0 002		0 002	1000				190 c	**0.11**	120	1100
BROMOMETHANE	0.003		0.003	1000				150 nc	**12**	20	3900
CADMIUM	1		1	2500				**41** nc			
CARBON TETRACHLORIDE	0.002		0.002	1000				12 c	**1.0**	(1 8) 20	10000
CHLORDANE	0 05		0.05	2500				2 0 c	51	200	**0.29**
CHLOROANILINE, p-		**1.3**		2500				440 nc	0 3		1.1
CHLOROBENZENE	0 002		0.002	1000				2200 nc	**2.4**	(200) 620	40
CHLOROFORM	0.002		0 006	1000				250 c	**0.13**	(1.3) 71	330
CHLOROPHENOL, 2-	**0.1**		0.1	2500				240 nc	0 0055		800
CHROMIUM (Total)	5		71	2500							

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS											
MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		**2500**				220000 nc			
CHROMIUM (VI)	2.5		2.5	2500				**600 nc**			
CHRYSENE	0.05		0.69	2500		19	Shl/Tex		**17**		100
COBALT'	2.5		21	**2500**				7200 nc			
COPPER'	5		85	**2500**				3400 nc			
CYANIDE (Free)	0.05		0.12	500				**100 nc**	1000000		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500		**1.9**	Shl/Tex		110		140
DIBROMOCHLOROMETHANE	0.003		0.003	500				18 c	**0.09**		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500				9900 nc	**0.88**	15000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500				9900 nc	**190**	15000	2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000				63 c	**0.32**	13000	2400
DICHLOROBENZIDINE, 3,3'-		**1.3**		2500				0.72 c	21		400
DDD	0.05			2500				**3.5 c**	3900		780
DDE	0.01			2500				**2.4 c**	22000		15000
DDT	0.05		1.4	2500				2.4 c	1200	64	**2.0**
DICHLOROETHANE, 1,1-	0.002		0.002	500				8500 nc	**3.0**	2200	2200
DICHLOROETHANE, 1,2-	0.002		0.002	1000				17 c	**0.05**	1.0	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000				2.5 c	0.72	**0.42**	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500				1100 nc	**2.3**		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000				2200 nc	**4.1**		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	2500				94 nc	**0.3**		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	500				12 c	**0.13**	1.5	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	1000				4.6 c	**0.04**	0.62	63
DIELDRIN	**0.05**		0.05	2500				0.04 c	0.025	14	0.025
DIETHYL PHTHALATE		0.66		2500				27000 nc	130		**0.71**
DIMETHYL PHTHALATE		0.66		2500				15000 nc	1200		**0.7**
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500				940 nc	**0.94**		140
DINITROPHENOL, 2,4-	**0.2**		0.2	2500				94 nc	0.12		4.1
DINITROTOLUENE, 2,4-		**0.66**		2500				1.8 c	0.004		17
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007			**1**	CCME				
ENDOSULFAN	0.04			2500				360 nc	**0.18**		0.29

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS											
MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	2500				15 nc	0 56		0 014
ETHYLBENZENE	0 002		0.002	1000				6000 nc	0.28	5800	5800
ETHYLENE DIBROMIDE	0.004		0.004	500				0 02 c	0.012	0.24	320
FLUORANTHENE	0 05		1.1	2500				2400 nc	840		840
FLUORENE	0.05		0.12	2500				2400 nc	340		350
HEPTACHLOR	0.05		0.05	2500				0.18 c	11	5.8	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	2500				0.09 c	12	140	680
HEXACHLOROBENZENE	0 01			2500				0.78 c	200	780	7300
HEXACHLOROBUTADIENE	0.01			2500				11 c	2.2	27	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500				0.64 c	2.5		0.49
HEXACHLOROETHANE	0.01			2500				13 c	6.5	260	1800
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		19	ShlTex		53		70
LEAD	10		120	2500		1000	MOEE 1				
MERCURY	0.05		0.23	2500				57 nc			
METHOXYCHLOR	0.05		0.05	2500				300 nc	12000		4.0
METHYL ETHYL KETONE		0.1		1000				66000 nc	0.27	38	38
METHYL ISOBUTYL KETONE		0.05		500				5500 nc	0.48	69	69
METHYL MERCURY				2500				18 nc			
METHYL TERT BUTYL ETHER		0.05		500				570 nc	5.7	410	410
METHYLENE CHLORIDE	0 003		0 003	1000				200 c	1.1	1100	1100
METHYLNAPHTHALENE, 2- (1-)	0 05		0 29	2500				4400 nc	1.2	1600	1600
MOLYBDENUM'	2 5		2.5	2500				550 nc			
NAPHTHALENE	0.05		0.09	2500				4400 nc	4.6	3500	1400
NICKEL	2 5		43	2500				710 nc			
PENTACHLOROPHENOL	0.1		0.1	2500				12 c	160	37000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)						100	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)						1000	MOEE 2				
PHENANTHRENE	0 05		0 69	2500		190	ShlTex		720		150
PHENOL	0.1		0.1	1000				28000 nc	64	760	390
POLYCHLORINATED BIPHENYLS	0 3		0.3			25	CCME				
PYRENE	0.05		1	2500				1800 nc	500		250

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)										
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW1	S-/GW2	S-/GW3
SELENIUM	1		1.9	**2500**				3100 nc			
SILVER	0.25		0.42	2500				**240 nc**			
STYRENE	0.002		0.002	1000				28 c	**1.7**	(42) 99	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500				4.9 c	**0.39**	2.9	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000				0.64 c	**0.01**	1.4	240
TETRACHLOROETHYLENE	0.002		0.002	1000				290 c	**0.45**	1500	760
THALLIUM	2.5		2.5	2500				**32 nc**			
TOLUENE	0.002		0.002	1000				19000 nc	**2.1**	3200	4300
TPH - refer to PETROLEUM HYDROCARBONS											
TRICHLOROBENZENE, 1,2,4-		0.66		2500				1300 nc	**110**	6000	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500				9900 nc	**34**	4400	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500				3.1 c	**0.28**	(11) 2900	2900
TRICHLOROETHYLENE	0.004		0.004	500				140 c	**3.9**	(14) 130	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500				4700 nc	**3.2**		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500				59 c	**0.66**	17000	3200
VANADIUM'	5		91	2500				**910 nc**			
VINYL CHLORIDE	0.003		0.003	500				0.50 c	0.38	**0.25**	100
XYLENES	0.002		0.002	1000				190000 nc	**25**	2900	4100
ZINC	25		160	**2500**				100000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57								
CHLORIDE ^	0.25		330								
NITRATE ^	5		61								
NITRITE ^	5		61								
SODIUM ADSORPTION RATIO (SAR) ***			2.4								
SODIUM ^	25										

c Cancer Risk nc Noncancer Risk ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Mass. direct soil contact risk value for Cr (III) was utilized for the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr(III), whereas Cr (VI) normally contributes very little to the total.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion not applicable. ^ Soil Criterion not available.

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Background.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	5000			17000 nc	**15**		1300
ACENAPHTHYLENE	0.05		0.08	5000			[2700] 1200 nc	**130**		840
ACETONE		0.1		2500			52000 nc	**3.5**	58	3.8
ALDRIN	0.05		0.05	5000			0.15 c	**0.08**	11	69
ANTHRACENE	0.05		0.16	5000			60000 nc	1500		**28**
ANTIMONY	1		1	5000			**[44] 21 nc**			
ARSENIC *	1		17	5000						
BARIUM*	2.5		210	[2500] 5000			**[8700] 4100 nc**			
BENZENE	0.002		0.002	2500			230 c	**0.24**	(3.0) 580	2400
BENZO(a)ANTHRACENE	0.05		0.74	5000	720	Shl/Tex		**6.6**		170
BENZO(a)PYRENE	0.05		0.49	5000	**7.2**	Shl/Tex		9.0	1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	5000	72	Shl/Tex		**18**		640
BENZO(g,h,i)PERYLENE	0.1		0.68	5000	720	Shl/Tex		**53**		**53**
BENZO(k)FLUORANTHENE	0.05		0.48	5000	72	Shl/Tex		**18**		37
BERYLLIUM	0.5		1.2	5000			**3.1 c**			
BIPHENYL, 1,1-		0.05		5000			3100 nc	**0.89**		4.3
BIS(2-CHLOROETHYL)ETHER		**0.66**		2500			0.59 c	0.01	1.5	110
BIS(2-CHLOROISOPROPYL)ETHER		**0.66**		2500			9.3 c	0.024	29	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		5000			1200 c	**100**	11000	500
BORON (Available)*										
BROMODICHLOROMETHANE		0.005		500			90 c	**0.12**		1200
BROMOFORM	0.002		0.002	2500			710 c	**0.11**	120	1100
BROMOMETHANE	0.003		0.003	2500			720 nc	**12**	20	3900
CADMIUM	1		1	5000			**[41] 19 nc**			
CARBON TETRACHLORIDE	0.002		0.002	2500			43 c	**1.0**	(1.8) 20	10000
CHLORDANE	0.05		0.05	5000			5.3 nc	51	200	**0.29**
CHLOROANILINE, p-		**1.3**		5000			[440] 210 nc	0.3		1.1
CHLOROBENZENE	0.002		0.002	2500			10000 nc	**2.4**	(200) 620	40
CHLOROFORM	0.002		0.006	2500			520 nc	**0.13**	(1.3) 71	330
CHLOROPHENOL, 2-	**0.1**		0.1	5000			1100 nc	0.0055		800
CHROMIUM (Total)	5		71							

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)		
CHEMICAL PARAMETER	Soil MDL	PQL	Background.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		**5000**			100000 nc			
CHROMIUM (VI)	2.5		2.5	5000			**1100 nc**			
CHRYSENE	0.05		0.69	5000	72	Shl/Tex		**17**		100
COBALT*	2.5		21	[2500] 5000			**[7200] 3400 nc**			
COPPER*	5		85	**[2500] 5000**			**[3400] 1600 nc**			
CYANIDE (Free)	0.05		0.12	1000			**390 nc**	1000000		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	5000	**7.2**	Shl/Tex		110		140
DIBROMOCHLOROMETHANE	0.003		0.003	500			67 c	**0.09**		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500			46000 nc	**0.88**	15000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500			46000 nc	**190**	15000	2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	2500			230 c	**0.32**	13000	2400
DICHLOROBENZIDINE, 3,3'-		1.3		5000			**2.7 c**	21		400
DDD	0.05			5000			**13 c**	3900		780
DDE	0.01			5000			**8.9 c**	22000		15000
DDT	0.05		1.4	5000			8.9 c	1200	64	**2.0**
DICHLOROETHANE, 1,1-	0.002		0.002	500			40000 nc	**3.0**	2200	2200
DICHLOROETHANE, 1,2-	0.002		0.002	2500			61 c	**0.05**	1.0	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	2500			9.1 c	0.72	**0.42**	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500			5200 nc	**2.3**		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	2500			10000 nc	**4.1**		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	5000			[94] 44 nc	**0.3**		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	1000			45 c	**0.13**	1.5	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	2500			17 c	**0.04**	0.62	63
DIELDRIN	**0.05**		0.05	5000			0.15 c	0.025	14	0.025
DIETHYL PHTHALATE		0.66		5000			1000000 nc	130		**0.71**
DIMETHYL PHTHALATE		0.66		5000			69000 nc	1200		**0.7**
DIMETHYLPHENOL, 2,4-	0.2		0.2	5000			4400 nc	**0.94**		140
DINITROPHENOL, 2,4-	**0.2**		0.2	5000			[94] 44 nc	0.12		4.1
DINITROTOLUENE, 2,4-		**0.66**		5000			6.6 c	0.004		17
DIOXIN / FURAN (ng TEQ / g soil) *	0.002		0.007							
ENDOSULFAN	0.04			5000			[360] 170 nc	**0.18**		0.29

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)		
CHEMICAL PARAMETER	Soil MDL	PQL	Background.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	5000			[15] 6.9 nc	0 56		0 014
ETHYLBENZENE	0 002		0.002	2500			28000 nc	0.28	5800	5800
ETHYLENE DIBROMIDE	0.004		0.004	500			0.066 c	0.012	0.24	320
FLUORANTHENE	0.05		1.1	5000			11000 nc	840		840
FLUORENE	0.05		0.12	5000			11000 nc	340		350
HEPTACHLOR	0 05		0.05	5000			0.68 c	11	5 8	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	5000			0.33 c	12	140	680
HEXACHLOROBENZENE	0 01			5000			2.8 c	200	780	7300
HEXACHLOROBUTADIENE	0.01			5000			39 c	2.2	27	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			5000			2.3 c	2 5		0.49
HEXACHLOROETHANE	0.01			5000			47 c	6.5	260	1800
INDENO(1,2,3-cd)PYRENE	0.1		0 38	5000	72	Sh/Tex		83		70
LEAD *	10		120	5000						
MERCURY	0 05		0 23	5000			[57] 27 nc			
METHOXYCHLOR	0.05		0 05	5000			[300] 140 nc	12000		4.0
METHYL ETHYL KETONE		0.1		2500			26000 nc	0.27	38	38
METHYL ISOBUTYL KETONE		0.05		1000			26000 nc	0.48	69	69
METHYL MERCURY				5000			[18] 8.4 nc			
METHYL TERT BUTYL ETHER		0 05		500			2700 nc	5.7	410	410
METHYLENE CHLORIDE	0 003		0.003	2500			740 c	1.1	1100	1100
METHYLNAPHTHALENE, 2- (*1-)	0 05		0.29	5000			[4400] 2100 nc	1.2	1600	1600
MOLYBDENUM*	2.5		2.5	5000			[550] 260 nc			
NAPHTHALENE	0 05		0 09	5000			[4400] 2100 nc	4.6	3500	1400
NICKEL	2.5		43	5000			[710] 330 nc			
PENTACHLOROPHENOL	0.1		0 1	5000			43 c	160	37000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)					100	MOEE 2				
PETROLEUM HYDROCARBONS (heavy oils)					1000	MOEE 2				
PHENANTHRENE	0.05		0.69	5000	720	Sh/Tex		720		150
PHENOL	0.1		0.1	2500			[28000] 13000 nc	64	760	390
POLYCHLORINATED BIPHENYLS	0 3		0.3							
PYRENE	0 05		1	5000			8400 nc	500		250

TABLE C: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)		
CHEMICAL PARAMETER	Soil MDL	PQL	Background.	Value	Value	Basis	S3 Risk	S-/GW1	S-/GW2	S-/GW3
SELENIUM	1		1.9	[2500] 5000			[3100] 1400 nc			
SILVER	0.25		0.42	5000			[240] 110 nc			
STYRENE	0.002		0.002	2500			100 c	1.7	(42) 99	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500			18 c	0.39	2.9	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	2500			2.4 c	0.01	1.4	240
TETRACHLOROETHYLENE	0.002		0.002	2500			1100 c	0.45	(280) 1500	760
THALLIUM	2.5		2.5	5000			150 nc			
TOLUENE	0.002		0.002	2500			88000 nc	2.1	3200	4300
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-		0.68		5000			[1300] 620 nc	110	6000	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500			46000 nc	34	4400	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500			12 c	0.28	(11) 2900	2900
TRICHLOROETHYLENE	0.004		0.004	500			510 nc	3.9	(14) 130	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	5000			22000 nc	3.2		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	5000			220 nc	0.66	17000	3200
VANADIUM*	5		91	5000			[910] 430 nc			
VINYL CHLORIDE	0.003		0.003	500			1.9 c	0.38	0.25	100
XYLENES	0.002		0.002	2500			[190000] 180000 nc	25	2900	4100
ZINC	25		160	5000			[100000] 47000 nc			
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57							
CHLORIDE *	0.25		330							
NITRATE *	5		61							
NITRITE *	5		61							
SODIUM ADSORPTION RATIO (SAR) ***			2.4							
SODIUM *	25									

c Cancer Risk nc Noncancer Risk [ ] S2 soil contact risk value/ceiling value shown in brackets when greater than S3 risk value.

* Soil criterion not available. ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ Soil contact risk value determined from human health toxicity data derived by MOEE Standard Development Branch staff.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion not applicable.

Appendix A.2.8: Table D Criteria Components - Medium/Fine Textured Soil (Sub-Surface) - Non-Potable Groundwater Situation

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	2500				3600 nc		1300
ACENAPHTHYLENE	0.05		0.08	2500				2700 nc		840
ACETONE		0.1		1000				11000 nc	58	3.8
ALDRIN	0.05		0.05	2500				0.04 c	11	69
ANTHRACENE	0.05		0.16	2500				13000 nc		28
ANTIMONY	1		1	2500				44 nc		
ARSENIC	1		17	2500	50					
BARIUM'	2.5		210	2500				8700 nc		
BENZENE	0.002		0.002	1000				.63 c	(3.0) 580	2400
BENZO(a)ANTHRACENE	0.05		0.74	2500		190	Sh/Tex			170
BENZO(a)PYRENE	0.05		0.49	2500		1.9	Sh/Tex		1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	2500		19	Sh/Tex			640
BENZO(g,h,i)PERYLENE	0.1		0.68	2500		190	Sh/Tex			53
BENZO(k)FLUORANTHENE	0.05		0.48	2500		19	Sh/Tex			37
BERYLLIUM	0.5		1.2	2500				0.85 c		
BIPHENYL, 1,1-		0.05		2500				6800 nc		4.3
BIS(2-CHLOROETHYL)ETHER		0.66		1000				0.16 c	1.5	110
BIS(2-CHLOROISOPROPYL)ETHER		0.66		1000				2.6 c	29	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		2500				330 c	11000	500
BORON (Available)*					2					
BROMODICHLOROMETHANE		0.005		500				25 c		1200
BROMOFORM	0.002		0.002	1000				190 c	120	1100
BROMOMETHANE	0.003		0.003	1000				150 nc	20	3900
CADMIUM	1		1	2500				41 nc		
CARBON TETRACHLORIDE	0.002		0.002	1000				12 c	(1.8) 20	10000
CHLORDANE	0.05		0.05	2500				2.0 c	200	0.20
CHLOROANILINE, p-		1.3		2500				440 nc		1.1
CHLOROBENZENE	0.002		0.002	1000				2200 nc	(200) 620	40
CHLOROFORM	0.002		0.006	1000				250 c	(1.3) 71	330
CHLOROPHENOL, 2-	0.1		0.1	2500				240 nc		500
CHROMIUM (Total)	5		71	2500						

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		2500				22000 nc		
CHROMIUM (VI)	2.5		2.5	2500				600 nc		
CHRYSENE	0.05		0.69	2500		19	Shl/Tex			100
COBALT*	2.5		21	2500				7200 nc		
COPPER*	5		85	2500				3400 nc		
CYANIDE (Free)	0.05		0.12	500				100 nc		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	2500		1.9	Shl/Tex			140
DIBROMOCHLOROMETHANE	0.003		0.003	500				18 c		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	500				9900 nc	15000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	500				9900 nc	15000	2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	1000				63 c	13000	2400
DICHLOROBENZIDINE, 3,3'-		1.3		2500				0.72 c		400
DDD	0.05			2500				3.5 c		780
DDE	0.01			2500				2.4 c		15000
DDT	0.05		1.4	2500				2.4 c	64	2.0
DICHLOROETHANE, 1,1-	0.002		0.002	500				8500 nc	2200	2200
DICHLOROETHANE, 1,2-	0.002		0.002	1000				17 c	1.0	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	1000				2.5 c	0.42	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500		2.3	Table C*	1100 nc		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	1000		4.1	Table C*	2200 nc		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	2500				94 nc		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	500				12 c	1.5	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	1000				4.6 c	0.62	63
DIELDRIN	0.05		0.05	2500				0.04 c	14	0.025
DIETHYL PHTHALATE		0.66		2500				270000 nc		0.71
DIMETHYL PHTHALATE		0.66		2500				150000 nc		0.7
DIMETHYLPHENOL, 2,4-	0.2		0.2	2500				940 nc		140
DINITROPHENOL, 2,4-	0.2		0.2	2500				94 nc		4.1
DINITROTOLUENE, 2,4-		0.66		2500				1.8 c		17
DIOXIN / FURAN (ng TEQ / g soil)	0.002		0.007			1	CCME			
ENDOSULFAN	0.04			2500				360 nc		0.29

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	2500				15 nc		0.014
ETHYLBENZENE	0.002		0.002	1000				6000 nc	5800	5800
ETHYLENE DIBROMIDE	0.004		0.004	500				0.02 c	0.24	320
FLUORANTHENE	0.05		1.1	2500				2400 nc		840
FLUORENE	0.05		0.12	2500				2400 nc		350
HEPTACHLOR	0.05		0.05	2500				0.18 c	5.8	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	2500				0.09 c	140	680
HEXACHLOROBENZENE	0.01			2500				0.76 c	780	7300
HEXACHLOROBUTADIENE	0.01			2500				11 c	27	460
HEXACHLOROCYCLOHEXANE, GAMMA	0.01			2500				0.64 c		0.49
HEXACHLOROETHANE	0.01			2500				13 c	260	1800
INDENO(1,2,3-cd)PYRENE	0.1		0.38	2500		19	Shl/Tex			70
LEAD	10		120	2500		1000	MOEE 1			
MERCURY	0.05		0.23	2500				57 nc		
METHOXYCHLOR	0.05		0.05	2500				300 nc		4.0
METHYL ETHYL KETONE		0.1		1000				66000 nc	38	38
METHYL ISOBUTYL KETONE		0.05		500				5500 nc	69	69
METHYL MERCURY				2500				18 nc		
METHYL TERT BUTYL ETHER		0.05		500				570 nc	410	410
METHYLENE CHLORIDE	0.003		0.003	1000				200 c	1100	1100
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	2500				4400 nc	1600	1600
MOLYBDENUM'	2.5		2.5	2500				550 nc		
NAPHTHALENE	0.05		0.09	2500				4400 nc	3500	1400
NICKEL	2.5		43	2500				710 nc		
PENTACHLOROPHENOL	0.1		0.1	2500				12 c	37000	880
PETROLEUM HYDROCARBONS (gasoline/diesel)						5000	MOEE 2			
PETROLEUM HYDROCARBONS (heavy oils)						5000	MOEE 2			
PHENANTHRENE	0.05		0.69	2500		190	Shl/Tex			180
PHENOL	0.1		0.1	1000				28000 nc	760	390
POLYCHLORINATED BIPHENYLS	0.3		0.3			25	CCME			
PYRENE	0.05		1	2500				1800 nc		250

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINE TEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	RESIDENTIAL/PARKLAND CATEGORY (ug/g)									
	MOEE	MASS.	ONT Soil	Ceiling	MOEE	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Ind. Ecotox.	Value	Basis	S2 Risk	S-/GW2	S-/GW3
SELENIUM	1		1.9	**2500**				3100 nc		
SILVER	0.25		0.42	2500				**240 nc**		
STYRENE	0.002		0.002	1000				**28 c**	(42) 99	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500				4.9 c	**2.9**	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	1000				**0.64 c**	1.4	240
TETRACHLOROETHYLENE	0.002		0.002	1000		**0.45**	Table C^a	290 c	(280) 1500	760
THALLIUM	2.5		2.5	2500				**32 nc**		
TOLUENE	0.002		0.002	**1000**				1900 nc	3200	4300
TPH - refer to PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-		0.66		2500				1300 nc	6000	**770**
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500		**34**	Table C^a	9900 nc	4400	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500				**3.1 nc**	(11) 2900	2900
TRICHLOROETHYLENE	0.004		0.004	500		**3.9**	Table C^a	140 c	(14) 130	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	2500				4700 nc		**10**
TRICHLOROPHENOL 2,4,6-	0.1		0.1	2500				**59 c**	17000	3200
VANADIUM*	5		91	2500				**910 nc**		
VINYL CHLORIDE	0.003		0.003	500				0.50 c	**0.25**	100
XYLENES	0.002		0.002	**1000**				190000 nc	2900	4100
ZINC	25		160	**2500**				100000 nc		
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57							
CHLORIDE ^	0.25		330							
NITRATE ^	5		61							
NITRITE ^	5		61							
SODIUM ADSORPTION RATIO (SAR) ***			2.4							
SODIUM ^	25									

c Cancer Risk nc Noncancer Risk ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-2 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch staff.

* MOEE Soil Clean-up Guideline (SCUG) for boron is based on a hot water extract, and was developed by MOEE Standards Development Branch staff.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

a Soil criterion from Table C (potable groundwater situation) adopted to account for degradation to vinyl chloride.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion not applicable. ^ Soil criterion not available

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINETEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
ACENAPHTHENE	0.05		0.07	5000			17000 nc		1300
ACENAPHTHYLENE	0.05		0.08	5000			[2700] 1200 nc		840
ACETONE		0.1		2500			52000 nc	58	3.8
ALDRIN	0.05		0.05	5000			0.15 c	11	69
ANTHRACENE	0.05		0.16	5000			60000 nc		28
ANTIMONY	1		1	5000			[44] 21 nc		
ARSENIC *	1		17	5000					
BARIUM*	2.5		210	[2500] 5000			[8700] 4100 nc		
BENZENE	0.002		0.002	2500			230 c	(3.0) 580	2400
BENZO(a)ANTHRACENE	0.05		0.74	5000	720	Shl/Tex			170
BENZO(a)PYRENE	0.05		0.49	5000	7.2	Shl/Tex		1700	1700
BENZO(b)FLUORANTHENE	0.05		0.47	5000	72	Shl/Tex			640
BENZO(g,h,i)PERYLENE	0.1		0.68	5000	720	Shl/Tex			53
BENZO(k)FLUORANTHENE	0.05		0.48	5000	72	Shl/Tex			37
BERYLLIUM	0.5		1.2	5000			3.1 c		
BIPHENYL, 1,1-		0.05		5000			3100 nc		4.3
BIS(2-CHLOROETHYL)ETHER		0.66		2500			0.59 c	1.5	110
BIS(2-CHLOROISOPROPYL)ETHER		0.66		2500			9.3 c	29	540
BIS(2-ETHYLHEXYL)PHTHALATE		0.66		5000			1200 c	11000	500
BORON (Available)*									
BROMODICHLOROMETHANE		0.005		500			90 c		1200
BROMOFORM	0.002		0.002	2500			710 c	120	1100
BROMOMETHANE	0.003		0.003	2500			720 nc	20	3900
CADMIUM	1		1	5000			[41] 19 nc		
CARBON TETRACHLORIDE	0.002		0.002	2500			43 c	(1.8) 20	10000
CHLORDANE	0.05		0.05	5000			5.3 nc	200	0.29
CHLOROANILINE, p-		1.3		5000			[440] 210 nc		1.1
CHLOROBENZENE	0.002		0.002	2500			10000 nc	(200) 620	40
CHLOROFORM	0.002		0.006	2500			520 nc	(1.3) 71	330
CHLOROPHENOL, 2-	0.1		0.1	5000			1100 nc		800
CHROMIUM (Total)	5		71						

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINETEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
CHROMIUM (III) **		1.4		**5000**			100000 nc		
CHROMIUM (VI)	2.5		2.5	5000			**1100 nc**		
CHRYSENE	0.05		0.69	5000	**72**	Shl/Tex			100
COBALT'	2.5		21	[2500] 5000			[7200] **3400 nc**		
COPPER'	5		85	**[2500]** 5000			[3400] 1600 nc		
CYANIDE (Free)	0.05		0.12	1000			**390 nc**		610000
DIBENZO(a,h)ANTHRACENE	0.1		0.16	5000	**7.2**	Shl/Tex			140
DIBROMOCHLOROMETHANE	0.003		0.003	500			**67 c**		930
DICHLOROBENZENE, 1,2- (o-DCB)	0.002		0.002	**500**			46000 nc	15000	2300
DICHLOROBENZENE, 1,3- (m-DCB)	0.002		0.002	**500**			46000 nc	15000	2300
DICHLOROBENZENE, 1,4- (p-DCB)	0.002		0.002	2500			**230 c**	13000	2400
DICHLOROBENZIDINE, 3,3'-		1.3		5000			**2.7 c**		400
DDD	0.05			5000			**13 c**		780
DDE	0.01			5000			**8.9 c**		15000
DDT	0.05		1.4	5000			8.9 c	64	**2.0**
DICHLOROETHANE, 1,1-	0.002		0.002	**500**			40000 nc	2200	2200
DICHLOROETHANE, 1,2-	0.002		0.002	2500			61 c	**1.0**	460
DICHLOROETHYLENE, 1,1-	0.002		0.002	2500			9.1 c	**0.42**	5200
DICHLOROETHYLENE, CIS-1,2-		0.005		500	**2.3**	Table C*	5200 nc		1700
DICHLOROETHYLENE, TRANS-1,2-	0.003		0.003	2500	**4.1**	Table C*	10000 nc		2100
DICHLOROPHENOL, 2,4-	0.01		0.1	5000			**[94] 44 nc**		3700
DICHLOROPROPANE, 1,2-	0.002		0.002	1000			45 c	**1.5**	1300
DICHLOROPROPENE, 1,3-	0.003		0.003	2500			17 c	**0.62**	63
DIELDRIN	**0.05**		0.05	5000			0.15 c	14	0.025
DIETHYL PHTHALATE		0.66		5000			1000000 nc		**0.71**
DIMETHYL PHTHALATE		0.66		5000			69000 nc		**0.7**
DIMETHYLPHENOL, 2,4-	0.2		0.2	5000			4400 nc		**140**
DINITROPHENOL, 2,4-	0.2		0.2	5000			[94] 44 nc		**4.1**
DINITROTOLUENE, 2,4-		0.66		5000			**6.6 c**		17
DIOXIN / FURAN (ng TEQ / g soil) *	0.002		0.007						
ENDOSULFAN	0.04			5000			[360] 170 nc		**0.29**

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINETEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod MASS.)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
ENDRIN	0.05		0.05	5000			[15] 6.9 nc		0.014
ETHYLBENZENE	0.002		0.002	2500			28000 nc	5800	5800
ETHYLENE DIBROMIDE	0.004		0.004	500			0.066 c	0.24	320
FLUORANTHENE	0.05		1.1	5000			11000 nc		840
FLUORENE	0.05		0.12	5000			11000 nc		350
HEPTACHLOR	0.05		0.05	5000			0.68 c	5.8	0.15
HEPTACHLOR EPOXIDE	0.05		0.05	5000			0.33 c	140	680
HEXACHLOROBENZENE	0.01			5000			2.8 c	780	7300
HEXACHLOROBUTADIENE	0.01			5000			39 c	27	460
HEXACHLOROCYCLOHEXANE-GAMMA	0.01			5000			2.3 c		0.49
HEXACHLOROETHANE	0.01			5000			47 c	280	1800
INDENO(1,2,3-cd)PYRENE	0.1		0.38	5000	72	Shl/Tex			70
LEAD *	10		120	5000					
MERCURY	0.05		0.23	5000			[67] 27 nc		
METHOXYCHLOR	0.05		0.05	5000			[300] 140 nc		4.0
METHYL ETHYL KETONE		0.1		2500			26000 nc	38	38
METHYL ISOBUTYL KETONE		0.05		1000			26000 nc	69	69
METHYL MERCURY				5000			[18] 8.4 nc		
METHYL TERT BUTYL ETHER		0.05		500			2700 nc	410	410
METHYLENE CHLORIDE	0.003		0.003	2500			740 c	1100	1100
METHYLNAPHTHALENE, 2- (*1-)	0.05		0.29	5000			[4400] 2100 nc	1600	1600
MOLYBDENUM*	2.5		2.5	5000			[650] 260 nc		
NAPHTHALENE	0.05		0.09	5000			[4400] 2100 nc	3500	1400
NICKEL	2.5		43	5000			[710] 330 nc		
PENTACHLOROPHENOL	0.1		0.1	5000			43 c	37000	680
PETROLEUM HYDROCARBONS (gasoline/diesel)					10000	MOEE 2			
PETROLEUM HYDROCARBONS (heavy oils)					10000	MOEE 2			
PHENANTHRENE	0.05		0.69	5000	720	Shl/Tex			150
PHENOL	0.1		0.1	2500			[28000] 13000 nc	760	[illegible]
POLYCHLORINATED BIPHENYLS *	0.3		0.3						
PYRENE	0.05		1	5000			8400 nc		250

TABLE D: COMPONENTS FOR MOEE SOIL REMEDIATION CRITERIA (SUB-SURFACE) - NON-POTABLE GROUNDWATER SITUATION - MEDIUM/FINETEXTURED SOILS

MEDIUM/FINE TEXTURED SOIL	INDUSTRIAL/COMMERCIAL CATEGORY (ug/g)								
	MOEE	MASS.	ONT Soil	Ceiling	Substitute Criteria		Soil Contact	Soil Leaching (Mod. MASS)	
CHEMICAL PARAMETER	Soil MDL	PQL	Bkgrd.	Value	Value	Basis	S3 Risk	S-/GW2	S-/GW3
SELENIUM	1		1.9	[2500] 5000			[3100] 1400 nc		
SILVER	0.25		0.42	5000			[240] 110 nc		
STYRENE	0.002		0.002	2500			100 c	(42) 99	840
TETRACHLOROETHANE, 1,1,1,2-		0.005		500			18 c	2.9	3900
TETRACHLOROETHANE, 1,1,2,2-	0.004		0.004	2500			2.4 c	1.4	240
TETRACHLOROETHYLENE	0.002		0.002	2500	0.45	Table C^{a}	1100 c	(280) 1500	760
THALLIUM	2.5		2.5	5000			150 nc		
TOLUENE	0.002		0.002	2500			88000 nc	3200	4300
TPH - refer to PETROLEUM HYDROCARBONS									
TRICHLOROBENZENE, 1,2,4-		0.66		5000			[1300] 620 nc	6000	770
TRICHLOROETHANE, 1,1,1-	0.002		0.009	500	34	Table C^{a}	46000 nc	4400	8500
TRICHLOROETHANE, 1,1,2-	0.002		0.002	500			12 c	(11) 2900	2900
TRICHLOROETHYLENE	0.004		0.004	500	3.9	Table C^{a}	510 nc	(14) 130	3900
TRICHLOROPHENOL, 2,4,5-	0.1		0.1	5000			22000 nc		10
TRICHLOROPHENOL 2,4,6-	0.1		0.1	5000			220 nc	17000	3200
VANADIUM'	5		91	5000			[910] 430 nc		
VINYL CHLORIDE	0.003		0.003	500			1.9 c	0.25	100
XYLENES	0.002		0.002	2500			[190000] 180000 nc	2900	4100
ZINC	25		160	5000			[100000] 47000 nc		
ELECTRICAL CONDUCTIVITY (mS/cm) ***	0.25		0.57						
CHLORIDE *	0.25		330						
NITRATE *	5		61						
NITRITE *	5		61						
SODIUM ADSORPTION RATIO (SAR) ***			2.4						
SODIUM *	25								

c Cancer Risk nc Noncancer Risk [ ] S2 soil contact risk value/ceiling value shown in brackets if greater than S3 risk value.

* Soil criterion is not available. ( ) Value in brackets is based on meeting the indoor air cancer risk concentration which is below the indoor air background concentration used in the Mass. approach.

+ S-3 Risk Value determined from human health toxicity data derived by MOEE Standards Development Branch.

** Mass. direct soil contact risk value for Cr (III) was utilized as the total Cr criterion. At depth, total Cr is overwhelmingly a function of Cr (III), whereas Cr (VI) normally contributes very little to the total.

a Soil criterion adopted from Table C (potable groundwater situation) to account for degradation to vinyl chloride.

(*1-) 2-methyl naphthalene soil criterion is applicable to 1-methyl naphthalene with the provision that if both are detected in the soil, the sum of the two concentrations cannot exceed the soil criterion.

*** Soil criterion is not applicable.

APPENDIX B: Detailed Rationale Support Documentation.

Appendix B.1: Criteria Development Spreadsheets Containing Toxicological and Contaminant Transport Input Parameters Utilized in the Derivation of Soil and Groundwater Criteria.

Appendix B.1.1: Derivation of Direct Contact S-1 Soil Concentration.

SOIL CATEGORY S-1	ORAL	ORAL										
DIRECT CONTACT LEVELS	RID	CANCER	RAF_Ch	RAF_Ch	RAF_Ca	RAF_Ca	SOIL	SOIL	ODOR	VAPOR	CEILING	CEILING
	(or substitute)	POTENCY	SOIL	SOIL	SOIL	SOIL	BKGRND	MDL/PQL	INDEX	PRESSURE		BASIS
	mg/kg/day	FACTOR	INGEST	DERMAL	INGEST	DERMAL	mg/kg	mg/kg		Torr		
CHEMICAL PARAMETER		1/(mg/kg/day)								@ 20-30 C		
ACENAPHTHENE	6.0E-02		1.00E+00	2.00E-01			7.00E-02	5.00E-02	0.00		1.00E+03	Non-Odor
ACENAPHTHYLENE	4.0E-02		9.10E-01	1.80E-01			8.00E-02	5.00E-02	0.00	2.90E-02	1.00E+02	Non-Odor
ACETONE	1.0E-01		1.00E+00	1.00E-01				1.00E-01	20.77	2.70E+02	5.00E+02	Odor-2
ALDRIN	3.0E-05	1.70E+01	1.00E+00	2.50E-01	1.00E+00	2.50E-01	6.00E-02	5.00E-02	5.87E-06	2.30E-05	1.00E+03	Non-Odor
ANTHRACENE	3.0E-01		1.00E+00	2 90E-01			1.60E-01	5.00E-02	0.00	1.70E-05	1.00E+03	Non-Odor
ANTIMONY	4.0E-04		1.00E+00	1.00E-01			1.00E+00	1.00E+00	0.00		1.00E+03	Non-Odor
BARIUM	7.0E-02		3.00E-01	1.00E-01			2.10E+02	2 50E+00	0.00		1.00E+03	Non-Odor
BENZENE	5.0E-03	2.90E-02	1.00E+00	8.00E-02	1.00E+00	8.00E-02	2.00E-03	2.00E-03	63.33	9.50E+01	5.00E+02	Odor-2
BENZO(a)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	7.40E-01	5.00E-02	0.00	5.00E-09	1.00E+03	Non-Odor
BENZO(a)PYRENE	4.0E-02	7.30E+00	9.10E-01	1.60E-01	1.00E+00	2.00E-01	4.90E-01	5 00E-02	0.00	5.00E-09	1.00E+03	Non-Odor
BENZO(b)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.70E-01	5.00E-02	0.00		1.00E+03	Non-Odor
BENZO(g,h,i)PERYLENE	4.0E-02		9.10E-01	1.80E-01			6.80E-01	1.00E-01	0.00	1.00E-10	1.00E+03	Non-Odor
BENZO(k)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.80E-01	5.00E-02	0.00	9.59E-11	1.00E+03	Non-Odor
BERYLLIUM	5.0E-03	4.30E+00	1.00E+00	3.00E-02	1.00E+00	3.00E-02	1.20E+00	5.00E-01	0.00		1.00E+03	Non-Odor
BIPHENYL, 1,1-	5.0E-02		1.00E+00	8.00E-02				5.00E-02	0.00		1.00E+03	Non-Odor
BIS(2-CHLOROETHYL)ETHER		1.10E+00			1.00E+00	1.00E+00		6.60E-01	14.49	7.10E-01	5.00E+02	Odor-2
BIS(2-CHLOROISOPROPYL)ETHER	4.0E-02	7.00E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		6.60E-01	2.66	8.50E-01	5.00E+02	Odor-2
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E-02	1.40E-02	1.00E+00	2.00E-02	1.00E+00	2.00E-02		6.60E-01	0.00		1.00E+03	Non-Odor
BROMODICHLOROMETHANE	2.0E-02	6.20E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01		5.00E-03	0.00	5.00E+01	1.00E+02	Volatility
BROMOFORM (tribromomethane)	2.0E-02	7.90E-03	1.00E+00	1.10E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.31	5.60E+00	5.00E+02	Odor-2
BROMOMETHANE	1.4E-03		1.00E+00	1.00E-01			3.00E-03	3.00E-03	71.00	1.42E+03	5.00E+02	Odor-2
CADMIUM	5.0E-04		1.00E+00	1.40E-01			1.00E+00	1.00E+00	0.00		1.00E+03	Non-Odor
CARBON TETRACHLORIDE	7.0E-04	1.30E-01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	11.30	1.13E+02	5.00E+02	Odor-2
CHLORDANE	6.0E-05	1.30E+00	1.00E+00	5.00E-02	1.00E+00	5.00E-02	5.00E-02	5.00E-02	7.12E-05	1.00E-05	1.00E+03	Non-Odor
CHLOROANILINE, p-	4.0E-03		1.00E+00	1.00E-01				1.30E+00	0.00	1.50E-02	1.00E+02	Non-Odor
CHLOROBENZENE	2 0E-02		1.00E+00	1.00E-01			2.00E-03	2.00E-03	53.64	1.18E+01	5.00E+02	Odor-2
CHLOROFORM	1.0E-02	6.10E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	6.00E-03	2.00E-03	1.88	1.60E+02	5.00E+02	Odor-2
CHLOROPHENOL, 2-	5.0E-03		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		1.00E+03	Non-Odor
CHROMIUM(III)	1.0E+00		1.00E+00	4.00E-02			7.10E+01	1.40E+00	0 00		1.00E+03	Non-Odor
CHROMIUM(VI)	5.0E-03		1.00E+00	9.00E-02			2.50E+00	2.50E+00	0.00		1.00E+03	Non-Odor
CHRYSENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	6.90E-01	5.00E-02	0.00	6.30E-09	1.00E+03	Non-Odor
COBALT	6.0E-02		5.00E-01	1.00E-01			2.10E+01	2 50E+00	0.00		1.00E+03	Non-Odor
COPPER	3 0E-02		9.00E-01	1.00E-01			8.50E+01	5.00E+00	0.00		1.00E+03	Non-Odor
CYANIDE	2.0E-02		1.00E+00	3.00E-01			1.20E-01	5.00E-02	1088.97	6 20E+02	1.00E+02	Odor-1
DIBENZO(a,h)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	8.00E-02	1.00E+00	9.00E-02	1.60E-01	1.00E-01	0.00	1.00E-10	1.00E+03	Non-Odor
DIBROMOCHLOROMETHANE	2.0E-02	8 40E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3 00E-03	3.00E-03	0.00	7.60E+01	1.00E+02	Volatility
DICHLOROBENZENE, 1,2- (o-DCB)	9 0E-02		1.00E+00	1.00E-01			2 00E-03	2 00E-03	0.03	1.50E+00	1.00E+02	Volatility
DICHLOROBENZENE, 1,3- (m-DCB)	9 0E-02		1.00E+00	1.00E-01			2.00E-03	2 00E-03	0.03	1.50E+00	1.00E+02	Volatility(o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)		2.40E-02			1.00E+00	1.00E-01	2 00E-03	2 00E-03	10 00	1.80E+00	5 00E+02	Odor-2
DICHLOROBENZIDINE, 3,3'-		4 50E-01			1.00E+00	5.40E-01		1.30E+00	0.00	4.50E-09	1.00E+03	Non-Odor
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)		2 40E-01			1 00E+00	2.00E-01		5.00E-02	0 00	1 00E-06	1.00E+03	Non-Odor
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)		3 40E-01			1 00E+00	2.00E-01		1.00E-02	0.00	6 50E-06	1.00E+03	Non-Odor
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	5.0E-04	3.40E-01	1 00E+00	2 00E-01	1.00E+00	2.00E-01	1.40E+00	5.00E-02	0.00	1.50E-07	1.00E+03	Non-Odor
DICHLOROETHANE, 1,1-	1.0E-01		1.30E+00	1.30E-01			2.00E-03	2.00E-03	0.47	2.34E+02	1.00E+02	Volatility
DICHLOROETHANE, 1,2- (ethlyene dichloride)	·2.0E-02	9.10E-02	1 00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2 00E-03	13.17	7.90E+01	5.00E+02	Odor-2
DICHLOROETHYLENE, 1,1-	9.0E-03	6.00E-01	1.00E+00	1.00E-01	1.02E+00	1.02E-01	2.00E-03	2.00E-03	1.18	5 91E+02	5.00E+02	Odor-2
DICHLOROETHYLENE, CIS-1,2-	1.0E-02		1.00E+00	1.00E-01				5 00E-03	0.00	2.02E+02	1.00E+02	Volatility
DICHLOROETHYLENE, TRANS-1,2-	2.0E-02		1.00E+00	1.00E-01			3.00E-03	3.00E-03	19.47	3.31E+02	5.00E+02	Odor-2
DICHLOROPHENOL, 2,4-	3.0E-03		1.00E+00	4.00E-01			1.00E-01	1.00E-01	0.32	6.70E-02	1 00E+02	Non-Odor
DICHLOROPROPANE, 1,2-		6 80E-02			1.00E+00	2.00E-01	2.00E-03	2.00E-03	168.00	4.20E+01	1.00E+02	Odor-1
DICHLOROPROPENE, 1,3-	3 0E-04	1.80E-01	1.00E+00	2.00E-01	1.00E+00	2.00E-01	3 00E-03	3 00E-03	43.00	4.30E+01	5 00E+02	Odor-2
DIELDRIN	5.0E-05	1.60E+01	1.00E+00	2.50E-01	1.00E+00	2.50E-01	5.00E-02	5.00E-02	0.00	1.80E-07	1.00E+03	Non-Odor

SOIL CATEGORY S-1 DIRECT CONTACT LEVELS	ORAL RfD (or substitute)	ORAL CANCER POTENCY FACTOR	RAF_Ch SOIL INGEST	RAF_Ch SOIL DERMAL	RAF_Ca SOIL INGEST	RAF_Ca SOIL DERMAL	SOIL BKGRND	SOIL MDL/PQL	ODOR INDEX	VAPOR PRESSURE	CEILING	CEILING BASIS
	mg/kg/day						mg/kg	mg/kg		Torr		
CHEMICAL PARAMETER		1/(mg/kg/day)								@ 20-30 C		
DIETHYL PHTHALATE	8.0E-01		1.00E+00	2.00E-02				6.60E-01	0.00		1.00E+03	Non-Odor
DIMETHYL PHTHALATE	1.0E+00		1.00E+00	7.00E-02				6.60E-01	0.00		1.00E+03	Non-Odor
DIMETHYLPHENOL, 2,4-	2.0E-02		1.00E+00	2.60E-01			2.00E-01	2.00E-01	0.00		1.00E+03	Non-Odor
DINITROPHENOL, 2,4-	2.0E-03		1.00E+00	2.60E-01			2.00E-01	2.00E-01	0.00		1.00E+03	Non-Odor
DINITROTOLUENE, 2,4-	2.0E-03	6.80E-01	1.00E+00	1.30E-01	1.00E+00	1.30E-01		6.60E-01	0.00	5.10E-03	1.00E+03	Non-Odor
ENDOSULFAN	6.0E-03		1.00E+00	2.00E-01				4.00E-02	0.00	1.00E-05	1.00E+03	Non-Odor
ENDRIN	3.0E-04		1.00E+00	2.50E-01			5.00E-02	5.00E-02	0.00	2.00E-07	1.00E+03	Non-Odor
ETHYLBENZENE	1.0E-01		1.00E+00	2.00E-01			2.00E-03	2.00E-03	4.35	1.00E+01	5.00E+02	Odor-2
ETHYLENE DIBROMIDE (dibromoethane, 1,2-)	2.0E-05	8.50E+01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.48	1.20E+01	1.00E+02	Volatility
FLUORANTHENE	4.0E-02		1.00E+00	2.00E-01			1.10E+00	6.00E-02	0.00	6.00E-06	1.00E+03	Non-Odor
FLUORENE	4.0E-02		1.00E+00	2.00E-01			1.20E-01	6.00E-02	0.00		1.00E+03	Non-Odor
HEPTACHLOR	5.0E-04	4.50E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	0.02	3.00E-04	1.00E+03	Non-Odor
HEPTACHLOR EPOXIDE	1.3E-05	9.10E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	1.37E-04	2.60E-08	1.00E+03	Non-Odor
HEXACHLOROBENZENE	8.0E-04	1.60E+00	1.00E+00	1.30E-01	1.00E+00	1.30E-01		1.00E-02	0.00	1.09E-05	1.00E+03	Non-Odor
HEXACHLOROBUTADIENE	2.0E-03	7.80E-02	1.00E+00	2.00E-01	1.00E+00	2.00E-01		1.00E-02	1.17E-03	1.50E-01	1.00E+02	Non-Odor
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.0E-04	1.30E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01		1.00E-02	0.00	9.40E-06	1.00E+03	Non-Odor
HEXACHLOROETHANE	1.0E-03	1.40E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		1.00E-02	0.00	4.00E-01	1.00E+02	Non-Odor
INDENO(1,2,3-cd)PYRENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	3.80E-01	1.00E-01	0.00	1.00E-09	1.00E+03	Non-Odor
MERCURY	3.0E-04		1.00E+00	5.00E-02			2.30E-01	5.00E-02	0.00	1.20E-03	1.00E+03	Non-Odor
METHOXYCHLOR	5.0E-03		1.00E+00	2.00E-01			5.00E-02	5.00E-02	0.00	1.40E-06	1.00E+03	Non-Odor
METHYL ETHYL KETONE	6.0E-01		1.00E+00	1.00E-01				1.00E-01	9.09	1.00E+02	5.00E+02	Odor-2
METHYL ISOBUTYL KETONE	5.0E-02		1.00E+00	1.00E-01				5.00E-02	100.00	1.00E+01	1.00E+02	Odor-1
METHYL MERCURY	3.0E-04		1.00E+00	2.00E-01				0.00E+00	0.00		1.00E+03	Non-Odor
METHYL TERT BUTYL ETHER	5.2E-03		1.00E+00	1.00E-01				5.00E-02	0.00	2.45E+02	1.00E+02	Volatility
METHYLENE CHLORIDE (dichlormethane)	6.0E-02	7.50E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3.00E-03	3.00E-03	2.68	4.29E+02	5.00E+02	Odor-2
METHYLNAPHTHALENE, 2-	4.0E-02		1.00E+00	1.00E-01			2.50E+00	5.00E-02	0.00		1.00E+03	Non-Odor
MOLYBDENUM	5.0E-03		1.00E+00	1.00E-01			2.50E+00	2.50E+00	0.00		1.00E+03	Non-Odor
NAPHTHALENE	4.0E-02		1.00E+00	1.00E-01			9.00E-02	5.00E-02	0.98	8.20E-02	1.00E+02	Non-Odor
NICKEL	2.0E-02		1.00E+00	3.50E-01			4.30E+01	2.50E+00	0.00		1.00E+03	Non-Odor
PENTACHLOROPHENOL	3.0E-02	1.20E-01	1.00E+00	1.10E-01	1.00E+00	1.10E-01	1.00E-01	1.00E-01	0.00	1.10E-04	1.00E+03	Non-Odor
PHENANTHRENE	4.0E-02		9.10E-01	1.80E-01			6.90E-01	5.00E-02	2.40E-03	9.60E-04	1.00E+03	Non-Odor
PHENOL	6.0E-01		1.00E+00	2.60E-01			1.00E-01	1.00E-01	8.75	3.50E-01	5.00E+02	Odor-2
PYRENE	3.0E-02		1.00E+00	2.00E-01			1.00E+00	5.00E-02	0.00	2.50E-06	1.00E+03	Non-Odor
SELENIUM	5.0E-03		1.00E+00	2.00E-03			1.90E+00	1.00E+00	0.00		1.00E+03	Non-Odor
SILVER	5.0E-03		1.00E+00	2.50E-01			4.20E-01	2.50E-01	0.00		1.00E+03	Non-Odor
STYRENE	2.0E-01	3.00E-02	1.00E+00	2.00E-01	1.00E+00	2.00E-01	2.00E-03	2.00E-03	16.67	5.00E+00	5.00E+02	Odor-2
TETRACHLOROETHANE, 1,1,1,2-	3.0E-02	2.60E-02	1.00E+00	1.40E+00	1.00E+00	1.40E+00		5.00E-03	0.00	1.00E+01	1.00E+02	Volatility
TETRACHLOROETHANE, 1,1,2,2-		2.00E-01			1.00E+00	1.40E+00	4.00E-03	4.00E-03	2.67	4.00E+00	5.00E+02	Odor-2
TETRACHLOROETHYLENE	1.0E-02	5.20E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.06	1.90E+01	5.00E+02	Odor-2
THALLIUM	7.0E-05		1.00E+00	1.00E-02			2.50E+00	2.50E+00	0.00		1.00E+03	Non-Odor
TOLUENE	2.0E-01		1.00E+00	1.20E-01			2.00E-03	2.00E-03	3.50	2.80E+01	5.00E+02	Odor-2
TRICHLOROBENZENE, 1,2,4-	1.0E-02		1.00E+00	8.00E-02				6.60E-01	0.00		1.00E+03	Non-Odor
TRICHLOROETHANE, 1,1,1-	9.0E-02		1.00E+00	1.00E-01			9.00E-03	2.00E-03	0.83	1.00E+02	1.00E+02	Volatility
TRICHLOROETHANE, 1,1,2-	4.0E-03	5.70E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	2.00E-03	2.00E-03	0.00	2.50E+01	1.00E+02	Volatility
TRICHLOROETHYLENE	2.0E-03	1.10E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.01	7.70E+01	1.00E+02	Volatility
TRICHLOROPHENOL, 2,4,5-	1.0E-01		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		1.00E+03	Non-Odor
TRICHLOROPHENOL 2,4,6-		1.10E-02			1.00E+00	2.60E-01	1.00E-01	1.00E-01	0.00		1.00E+03	Non-Odor
VANADIUM	7.0E-03		5.00E-02	1.00E-01			9.10E+01	5.00E+00	0.00		1.00E+03	Non-Odor
VINYL CHLORIDE (chloroethylene)	1.0E-03	1.90E+00	1.00E+00	1.00E-01	1.53E+00	1.60E-01	3.00E-03	3.00E-03	0.86	2.58E+03	1.00E+02	Volatility
XYLENES (Mixed Isomers)	2.0E+00		1.00E+00	1.20E-01			2.00E-03	2.00E-03	60.00	6.00E+00	5.00E+02	Odor-2
ZINC	3.0E-01		1.00E+00	2.00E-02			1.60E+02	2.50E+01	0.00		1.00E+03	Non-Odor

SOIL CATEGORY S-1 DIRECT CONTACT LEVELS CHEMICAL PARAMETER	RISK-BASED NONCANCER H.I. = 2.00E-01 mg/kg	RISK-BASED CANCER ELCR = 1.00E-06 mg/kg	CANCER RISK-BASED CONC. 1.00E-06 mg/kg	LOWEST RISK-BASED CONCENTRATION mg/kg	HIGHEST RISK, PQL & BACKGROUND mg/kg	LOWEST CEILING, (RISK,PQL, BCKGRND) mg/kg	S-1 DIRECT CONTACT STANDARD mg/kg	BASIS
ACENAPHTHENE	1.4E+03	0.0E+00	0.00	1.4E+03	1.4E+03	1.00E+03	1000.00	Ceiling
ACENAPHTHYLENE	1.0E+03	0.0E+00	0.00	1.0E+03	1.0E+03	1.00E+02	100.00	Ceiling
ACETONE	3.4E+03	0.0E+00	0.00	3.4E+03	3.4E+03	5.00E+02	500.00	Ceiling
ALDRIN	5.9E-01	2.6E-02	0.03	2.6E-02	5.0E-02	5.00E-02	0.05	Background
ANTHRACENE	5.3E+03	0.0E+00	0.00	5.3E+03	5.3E+03	1.00E+03	1000.00	Ceiling
ANTIMONY	1.3E+01	0.0E+00	0.00	1.3E+01	1.3E+01	1.34E+01	13.45	Noncancer Risk
BARIUM	3.7E+03	0.0E+00	0.00	3.7E+03	3.7E+03	1.00E+03	1000.00	Ceiling
BENZENE	1.9E+02	3.5E+01	34.69	3.5E+01	3.5E+01	3.47E+01	34.69	Cancer Risk
BENZO(a)ANTHRACENE	1.0E+03	7.3E-02	0.07	7.3E-02	7.4E-01	7.40E-01	0.74	Background
BENZO(a)PYRENE	1.0E+03	7.3E-02	0.07	7.3E-02	4.9E-01	4.90E-01	0.49	Background
BENZO(b)FLUORANTHENE	1.0E+03	7.3E-02	0.07	7.3E-02	4.7E-01	4.70E-01	0.47	Background
BENZO(g,h,i)PERYLENE	1.0E+03	0.0E+00	0.00	1.0E+03	1.0E+03	1.00E+03	1000.00	Ceiling
BENZO(k)FLUORANTHENE	1.0E+03	7.3E-02	0.07	7.3E-02	4.8E-01	4.80E-01	0.48	Background
BERYLLIUM	2.5E+02	3.7E-01	0.37	3.7E-01	1.2E+00	1.20E+00	1.20	Background
BIPHENYL, 1,1-	1.9E+03	0.0E+00	0.00	1.9E+03	1.9E+03	1.00E+03	1000.00	Ceiling
BIS(2-CHLOROETHYL)ETHER	0.0E+00	1.2E-01	0.12	1.2E-01	6.6E-01	6.60E-01	0.66	PQL
BIS(2-CHLOROISOPROPYL)ETHER	2.5E+02	1.9E+00	1.85	1.9E+00	1.9E+00	1.85E+00	1.85	Cancer Risk
BIS(2-ETHYLHEXYL)PHTHALATE	1.1E+03	1.3E+02	128.47	1.3E+02	1.3E+02	1.28E+02	128.47	Cancer Risk
BROMODICHLOROMETHANE	6.7E+02	1.4E+01	14.15	1.4E+01	1.4E+01	1.41E+01	14.15	Cancer Risk
BROMOFORM (tribromomethane)	6.4E+02	1.1E+02	111.04	1.1E+02	1.1E+02	1.11E+02	111.04	Cancer Risk
BROMOMETHANE	4.7E+01	0.0E+00	0.00	4.7E+01	4.7E+01	4.71E+01	47.06	Noncancer Risk
CADMIUM	1.4E+01	0.0E+00	0.00	1.4E+01	1.4E+01	1.41E+01	14.10	Noncancer Risk
CARBON TETRACHLORIDE	2.4E+01	6.7E+00	6.75	6.7E+00	6.7E+00	6.75E+00	6.75	Cancer Risk
CHLORDANE	2.7E+00	9.9E-01	0.99	9.9E-01	9.9E-01	9.93E-01	0.99	Cancer Risk
CHLOROANILINE, p-	1.3E+02	0.0E+00	0.00	1.3E+02	1.3E+02	1.00E+02	100.00	Ceiling
CHLOROBENZENE	6.7E+02	0.0E+00	0.00	6.7E+02	6.7E+02	5.00E+02	500.00	Ceiling
CHLOROFORM	3.4E+02	1.4E+02	143.80	1.4E+02	1.4E+02	1.44E+02	143.80	Cancer Risk
CHLOROPHENOL, 2-	9.5E+01	0.0E+00	0.00	9.5E+01	9.5E+01	9.51E+01	95.15	Noncancer Risk
CHROMIUM(III)	4.7E+04	0.0E+00	0.00	4.7E+04	4.7E+04	1.00E+03	1000.00	Ceiling
CHROMIUM(VI)	1.8E+02	0.0E+00	0.00	1.8E+02	1.8E+02	1.77E+02	176.52	Noncancer Risk
CHRYSENE	1.0E+03	7.3E-02	0.07	7.3E-02	6.9E-01	6.90E-01	0.69	Background
COBALT	2.7E+03	0.0E+00	0.00	2.7E+03	2.7E+03	1.00E+03	1000.00	Ceiling
COPPER	1.1E+03	0.0E+00	0.00	1.1E+03	1.1E+03	1.00E+03	1000.00	Ceiling
CYANIDE	1.0E+02	0.0E+00	0.00	1.0E+02	1.0E+02	1.00E+02	100.00	Noncancer Risk
DIBENZO(a,h)ANTHRACENE	1.6E+03	1.3E-01	0.13	1.3E-01	1.6E-01	1.60E-01	0.16	Background
DIBROMOCHLOROMETHANE	6.7E+02	1.0E+01	10.44	1.0E+01	1.0E+01	1.04E+01	10.44	Cancer Risk
DICHLOROBENZENE, 1,2- (o-DCB)	3.0E+03	0.0E+00	0.00	3.0E+03	3.0E+03	1.00E+02	100.00	Ceiling
DICHLOROBENZENE, 1,3- (m-DCB)	3.0E+03	0.0E+00	0.00	3.0E+03	3.0E+03	1.00E+02	100.00	Ceiling(o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)	0.0E+00	3.7E+01	36.55	3.7E+01	3.7E+01	3.65E+01	36.55	Cancer Risk
DICHLOROBENZIDINE, 3,3'-	0.0E+00	5.1E-01	0.51	5.1E-01	1.3E+00	1.30E+00	1.30	PQL
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	0.0E+00	2.2E+00	2.23	2.2E+00	2.2E+00	2.23E+00	2.23	Cancer Risk
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	0.0E+00	1.6E+00	1.57	1.6E+00	1.6E+00	1.57E+00	1.57	Cancer Risk
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	1.1E+01	1.6E+00	1.57	1.6E+00	1.6E+00	1.57E+00	1.57	Cancer Risk
DICHLOROETHANE, 1,1-	2.6E+03	0.0E+00	0.00	2.6E+03	2.6E+03	1.00E+02	100.00	Ceiling
DICHLOROETHANE, 1,2- (ethlyene dichloride)	6.7E+02	9.6E+00	9.64	9.6E+00	9.6E+00	9.64E+00	9.64	Cancer Risk
DICHLOROETHYLENE, 1,1-	3.0E+02	1.4E+00	1.43	1.4E+00	1.4E+00	1.43E+00	1.43	Cancer Risk
DICHLOROETHYLENE, CIS-1,2-	3.4E+02	0.0E+00	0.00	3.4E+02	3.4E+02	1.00E+02	100.00	Ceiling
DICHLOROETHYLENE, TRANS-1,2-	6.7E+02	0.0E+00	0.00	6.7E+02	6.7E+02	5.00E+02	500.00	Ceiling
DICHLOROPHENOL, 2,4-	4.1E+01	0.0E+00	0.00	4.1E+01	4.1E+01	4.14E+01	41.38	Noncancer Risk
DICHLOROPROPANE, 1,2-	0.0E+00	7.9E+00	7.86	7.9E+00	7.9E+00	7.86E+00	7.86	Cancer Risk
DICHLOROPROPENE, 1,3-	6.8E+00	3.0E+00	2.97	3.0E+00	3.0E+00	2.97E+00	2.97	Cancer Risk
DIELDRIN	9.8E-01	2.8E-02	0.03	2.8E-02	5.0E-02	5.00E-02	0.05	Background

SOIL CATEGORY S-1 DIRECT CONTACT LEVELS	RISK-BASED NONCANCER H.I. = 2.00E-01 mg/kg	RISK-BASED CANCER ELCR = 1.00E-06 mg/kg	CANCER RISK-BASED CONC. 1.00E-06 mg/kg	LOWEST RISK-BASED CONCENTRATION mg/kg	HIGHEST RISK, PQL & BACKGROUND mg/kg	LOWEST CEILING, (RISK,PQL, BCKGRND) mg/kg	S-1 DIRECT CONTACT STANDARD mg/kg	BASIS
CHEMICAL PARAMETER								
DIETHYL PHTHALATE	4.4E+04	0.0E+00	0.00	4.4E+04	4.4E+04	1.00E+03	1000.00	Ceiling
DIMETHYL PHTHALATE	3.9E+04	0.0E+00	0.00	3.9E+04	3.9E+04	1.00E+03	1000.00	Ceiling
DIMETHYLPHENOL, 2,4-	3.8E+02	0.0E+00	0.00	3.8E+02	3.8E+02	3.81E+02	380.59	Noncancer Risk
DINITROPHENOL, 2,4-	3.8E+01	0.0E+00	0.00	3.8E+01	3.8E+01	3.81E+01	38.06	Noncancer Risk
DINITROTOLUENE, 2,4-	5.9E+01	1.1E+00	1.08	1.1E+00	1.1E+00	1.08E+00	1.08	Cancer Risk
ENDOSULFAN	1.4E+02	0.0E+00	0.00	1.4E+02	1.4E+02	1.36E+02	136.00	Noncancer Risk
ENDRIN	5.9E+00	0.0E+00	0.00	5.9E+00	5.9E+00	5.87E+00	5.87	Noncancer Risk
ETHYLBENZENE	2.3E+03	0.0E+00	0.00	2.3E+03	2.3E+03	5.00E+02	500.00	Ceiling
ETHYLENE DIBROMIDE (dibromoethane, 1,2-)	6.7E-01	1.0E-02	0.01	1.0E-02	1.0E-02	1.03E-02	0.01	Cancer Risk
FLUORANTHENE	9.1E+02	0.0E+00	0.00	9.1E+02	9.1E+02	9.09E+02	909.09	Noncancer Risk
FLUORENE	9.1E+02	0.0E+00	0.00	9.1E+02	9.1E+02	9.09E+02	909.09	Noncancer Risk
HEPTACHLOR	1.1E+01	1.2E-01	0.12	1.2E-01	1.2E-01	1.19E-01	0.12	Cancer Risk
HEPTACHLOR EPOXIDE	3.0E+01	5.9E-02	0.06	5.9E-02	5.9E-02	5.88E-02	0.06	Cancer Risk
HEXACHLOROBENZENE	2.4E+01	4.6E-01	0.46	4.6E-01	4.6E-01	4.60E-01	0.46	Cancer Risk
HEXACHLOROBUTADIENE	4.5E+01	6.9E+00	6.86	6.9E+00	6.9E+00	6.86E+00	6.86	Cancer Risk
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	6.8E+00	4.1E-01	0.41	4.1E-01	4.1E-01	4.11E-01	0.41	Cancer Risk
HEXACHLOROETHANE	6.3E+00	9.3E+00	9.26	6.3E+00	6.3E+00	6.33E+00	6.33	Noncancer Risk
INDENO(1,2,3-cd)PYRENE	1.0E+03	7.3E-02	0.07	7.3E-02	3.8E-01	3.80E-01	0.38	Background
MERCURY	1.3E+01	0.0E+00	0.00	1.3E+01	1.3E+01	1.33E+01	13.26	Noncancer Risk
METHOXYCHLOR	1.1E+02	0.0E+00	0.00	1.1E+02	1.1E+02	1.14E+02	113.64	Noncancer Risk
METHYL ETHYL KETONE	2.0E+04	0.0E+00	0.00	2.0E+04	2.0E+04	5.00E+02	500.00	Ceiling
METHYL ISOBUTYL KETONE	1.7E+03	0.0E+00	0.00	1.7E+03	1.7E+03	1.00E+02	100.00	Ceiling
METHYL MERCURY	6.8E+00	0.0E+00	0.00	6.8E+00	6.8E+00	6.82E+00	6.82	Noncancer Risk
METHYL TERT BUTYL ETHER	1.7E+02	0.0E+00	0.00	1.7E+02	1.7E+02	1.00E+02	100.00	Ceiling
METHYLENE CHLORIDE (dichlormethane)	2.0E+03	1.2E+02	116.96	1.2E+02	1.2E+02	1.17E+02	116.96	Cancer Risk
METHYLNAPHTHALENE, 2-	1.3E+03	0.0E+00	0.00	1.3E+03	1.3E+03	1.00E+03	1000.00	Ceiling
MOLYBDENUM	1.7E+02	0.0E+00	0.00	1.7E+02	1.7E+02	1.68E+02	166.00	Noncancer Risk
NAPHTHALENE	1.3E+03	0.0E+00	0.00	1.3E+03	1.3E+03	1.00E+02	100.00	Ceiling
NICKEL	3.1E+02	0.0E+00	0.00	3.1E+02	3.1E+02	3.06E+02	305.93	Noncancer Risk
PENTACHLOROPHENOL	9.6E+02	6.9E+00	6.87	6.9E+00	6.9E+00	6.87E+00	6.87	Cancer Risk
PHENANTHRENE	1.0E+03	0.0E+00	0.00	1.0E+03	1.0E+03	1.00E+03	1000.00	Ceiling
PHENOL	1.1E+04	0.0E+00	0.00	1.1E+04	1.1E+04	5.00E+02	500.00	Ceiling
PYRENE	6.8E+02	0.0E+00	0.00	6.8E+02	6.8E+02	6.82E+02	681.82	Noncancer Risk
SELENIUM	3.2E+02	0.0E+00	0.00	3.2E+02	3.2E+02	3.17E+02	316.76	Noncancer Risk
SILVER	9.8E+01	0.0E+00	0.00	9.8E+01	9.8E+01	9.78E+01	97.60	Noncancer Risk
STYRENE	4.5E+03	1.8E+01	17.83	1.8E+01	1.8E+01	1.78E+01	17.83	Cancer Risk
TETRACHLOROETHANE, 1,1,1,2-	1.4E+02	3.6E+00	3.62	3.6E+00	3.6E+00	3.62E+00	3.62	Cancer Risk
TETRACHLOROETHANE, 1,1,2,2-	0.0E+00	4.7E-01	0.47	4.7E-01	4.7E-01	4.70E-01	0.47	Cancer Risk
TETRACHLOROETHYLENE	3.4E+02	1.7E+02	168.69	1.7E+02	1.7E+02	1.69E+02	168.69	Cancer Risk
THALLIUM	4.1E+00	0.0E+00	0.00	4.1E+00	4.1E+00	4.14E+00	4.14	Noncancer Risk
TOLUENE	6.1E+03	0.0E+00	0.00	6.1E+03	6.1E+03	5.00E+02	500.00	Ceiling
TRICHLOROBENZENE, 1,2,4-	3.7E+02	0.0E+00	0.00	3.7E+02	3.7E+02	3.72E+02	371.75	Noncancer Risk
TRICHLOROETHANE, 1,1,1-	3.0E+03	0.0E+00	0.00	3.0E+03	3.0E+03	1.00E+02	100.00	Ceiling
TRICHLOROETHANE, 1,1,2-	2.5E+01	2.3E+00	2.28	2.3E+00	2.3E+00	2.28E+00	2.28	Cancer Risk
TRICHLOROETHYLENE	6.7E+01	8.0E+01	79.74	6.7E+01	6.7E+01	6.72E+01	67.23	Noncancer Risk
TRICHLOROPHENOL, 2,4,5-	1.9E+03	0.0E+00	0.00	1.9E+03	1.9E+03	1.00E+03	1000.00	Ceiling
TRICHLOROPHENOL 2,4,6-	0.0E+00	3.9E+01	39.39	3.9E+01	3.9E+01	3.94E+01	39.39	Cancer Risk
VANADIUM	4.7E+02	0.0E+00	0.00	4.7E+02	4.7E+02	4.66E+02	466.00	Noncancer Risk
VINYL CHLORIDE (chloroethylene)	3.4E+01	2.9E-01	0.29	2.9E-01	2.9E-01	2.93E-01	0.29	Cancer Risk
XYLENES (Mixed Isomers)	6.1E+04	0.0E+00	0.00	6.1E+04	6.1E+04	5.00E+02	500.00	Ceiling
ZINC	1.6E+04	0.0E+00	0.00	1.6E+04	1.6E+04	1.00E+03	1000.00	* Sludge Stnd

Appendix B.1.2: Derivation of Direct Contact S-2 Soil Concentration.

SOIL CATEGORY S-2	ORAL	ORAL										
DIRECT CONTACT LEVELS	RfD	CANCER	RAF_Ch	RAF_Ch	RAF_Ca	RAF_Ca	SOIL	SOIL	ODOR	VAPOR	CEILING	CEILING
	(or substitute)	POTENCY	SOIL	SOIL	SOIL	SOIL	BKGRND	MDL/PQL	INDEX	PRESSURE		BASIS
	mg/kg/day	FACTOR	INGEST	DERMAL	INGEST	DERMAL	mg/kg	mg/kg		Torr		
CHEMICAL PARAMETER		1/(mg/kg/day)								@ 20-30 C		
ACENAPHTHENE	6.0E-02		1.00E+00	2.00E-01			7.00E-02	5.00E-02	0.00		2.50E+03	Non-Odor
ACENAPHTHYLENE	4.0E-02		9.10E-01	1.80E-01			8.00E-02	5.00E-02	0.00	2.90E-02	2.50E+03	Non-Odor
ACETONE	1.0E-01		1.00E+00	1.00E-01				1.00E-01	20.77	2.70E+02	1.00E+03	Odor-2
ALDRIN	3.0E-05	1.70E+01	1.00E+00	2.50E-01	1.00E+00	2.50E-01	5.00E-02	5.00E-02	5.87E-06	2.30E-05	2.50E+03	Non-Odor
ANTHRACENE	3.0E-01		1.00E+00	2.90E-01			1.60E-01	5.00E-02	0.00	1.70E-05	2.50E+03	Non-Odor
ANTIMONY	4.0E-04		1.00E+00	1.00E-01			1.00E+00	1.00E+00	0.00		2.50E+03	Non-Odor
BARIUM	7.0E-02		3.00E-01	1.00E-01			2.10E+02	2.50E+00	0.00		2.50E+03	Non-Odor
BENZENE	5.0E-03	2.90E-02	1.00E+00	8.00E-02	1.00E+00	8.00E-02	2.00E-03	2.00E-03	63.33	9.50E+01	1.00E+03	Odor-2
BENZO(a)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	7.40E-01	5.00E-02	0.00	5.00E-09	2.50E+03	Non-Odor
BENZO(a)PYRENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.90E-01	5.00E-02	0.00	5.00E-09	2.50E+03	Non-Odor
BENZO(b)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.70E-01	5.00E-02	0.00		2.50E+03	Non-Odor
BENZO(g,h,i)PERYLENE	4.0E-02		9.10E-01	1.80E-01			6.80E-01	1.00E-01	0.00	1.00E-10	2.50E+03	Non-Odor
BENZO(k)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.80E-01	5.00E-02	0.00	9.59E-11	2.50E+03	Non-Odor
BERYLLIUM	5.0E-03	4.30E+00	1.00E+00	3.00E-02	1.00E+00	3.00E-02	1.20E+00	5.00E-01	0.00		2.50E+03	Non-Odor
BIPHENYL, 1,1-	5.0E-02		1.00E+00	8.00E-02				5.00E-02	0.00		2.50E+03	Non-Odor
BIS(2-CHLOROETHYL)ETHER		1.10E+00			1.00E+00	1.00E+00		6.60E-01	14.49	7.10E-01	1.00E+03	Odor-2
BIS(2-CHLOROISOPROPYL)ETHER	4.0E-02	7.00E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		6.60E-01	2.68	8.50E-01	1.00E+03	Odor-2
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E-02	1.40E-02	1.00E+00	2.00E-02	1.00E+00	2.00E-02		6.60E-01	0.00		2.50E+03	Non-Odor
BROMODICHLOROMETHANE	2.0E-02	6.20E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01		5.00E-03	0.00	5.00E+01	5.00E+02	Volatility
BROMOFORM	2.0E-02	7.90E-03	1.00E+00	1.10E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.31	5.60E+00	1.00E+03	Odor-2
BROMOMETHANE	1.4E-03		1.00E+00	1 00E-01			3.00E-03	3.00E-03	71.00	1.42E+03	1.00E+03	Odor-2
CADMIUM	5.0E-04		1.00E+00	1.40E-01			1.00E+00	1.00E+00	0.00		2.50E+03	Non-Odor
CARBON TETRACHLORIDE	7.0E-04	1.30E-01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	11.30	1.13E+02	1.00E+03	Odor-2
CHLORDANE	6.0E-05	1.30E+00	1.00E+00	5.00E-02	1.00E+00	5.00E-02	5.00E-02	5.00E-02	7.12E-05	1.00E-05	2.50E+03	Non-Odor
CHLOROANILINE, p-	4.0E-03		1.00E+00	1.00E-01				1.30E+00	0.00	1.50E-02	2.50E+03	Non-Odor
CHLOROBENZENE	2.0E-02		1.00E+00	1.00E-01			2.00E-03	2.00E-03	53.64	1.18E+01	1.00E+03	Odor-2
CHLOROFORM	1.0E-02	6.10E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	6.00E-03	2.00E-03	1.88	1.60E+02	1.00E+03	Odor-2
CHLOROPHENOL, 2-	5.0E-03		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		2.50E+03	Non-Odor
CHROMIUM(III)	1.0E+00		1.00E+00	4.00E-02			7.10E+01	1.40E+00	0.00		2.50E+03	Non-Odor
CHROMIUM(VI)	5.0E-03		1.00E+00	9.00E-02			2.50E+00	2.50E+00	0.00		2.50E+03	Non-Odor
CHRYSENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	6.90E-01	5.00E-02	0.00	6.30E-09	2.50E+03	Non-Odor
COBALT	6.0E-02		5.00E-01	1.00E-01			2.10E+01	2.50E+00	0.00		2.50E+03	Non-Odor
COPPER	3.0E-02		9.00E-01	1.00E-01			8.50E+01	5.00E+00	0.00		2.50E+03	Non-Odor
CYANIDE	2 0E-02		1.00E+00	3.00E-01			1.20E-01	5.00E-02	1068.97	6.20E+02	5.00E+02	Odor-1
DIBENZO(a,h)ANTHRACENE	4 0E-02	7.30E+00	9.10E-01	8.00E-02	1 00E+00	9.00E-02	1 60E-01	1.00E-01	0.00	1.00E-10	2.50E+03	Non-Odor
DIBROMOCHLOROMETHANE	2.0E-02	8.40E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3 00E-03	3.00E-03	0.00	7.60E+01	5.00E+02	Volatility
DICHLOROBENZENE, 1,2- (o-DCB)	9.0E-02		1.00E+00	1.00E-01			2.00E-03	2.00E-03	0.03	1.50E+00	5.00E+02	Volatility
DICHLOROBENZENE, 1,3- (m-DCB)	9.0E-02		1.00E+00	1.00E-01			2.00E-03	2.00E-03	0 03	1.50E+00	5 00E+02	Volatility(o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)		2.40E-02			1.00E+00	1.00E-01	2.00E-03	2.00E-03	10.00	1.80E+00	1.00E+03	Odor-2
DICHLOROBENZIDINE, 3,3'-		4 50E-01			1.00E+00	5.40E-01		1.30E+00	0.00	4.50E-09	2.50E+03	Non-Odor
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)		2 40E-01			1.00E+00	2.00E-01		5.00E-02	0.00	1.00E-06	2 50E+03	Non-Odor
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)		3.40E-01			1 00E+00	2.00E-01		1.00E-02	0.00	6 50E-06	2 50E+03	Non-Odor
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	5.0E-04	3.40E-01	1.00E+00	2.00E-01	1.00E+00	2 00E-01	1.40E+00	5.00E-02	0.00	1.50E-07	2.50E+03	Non-Odor
DICHLOROETHANE, 1,1-	1 0E-01		1.30E+00	1.30E-01			2 00E-03	2.00E-03	0.47	2 34E+02	5 00E+02	Volatility
DICHLOROETHANE, 1,2-	2 0E-02	9.10E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	13.17	7.90E+01	1.00E+03	Odor-2
DICHLOROETHYLENE, 1,1-	9.0E-03	6.00E-01	1.00E+00	1.00E-01	1.02E+00	1.02E-01	2.00E-03	2.00E-03	1.18	5.91E+02	1.00E+03	Odor-2
DICHLOROETHYLENE, CIS-1,2-	1.0E-02		1.00E+00	1.00E-01				5 00E-03	0.00	2.02E+02	5.00E+02	Volatility
DICHLOROETHYLENE, TRANS-1,2-	2.0E-02		1.00E+00	1.00E-01			3.00E-03	3.00E-03	19.47	3.31E+02	1.00E+03	Odor-2
DICHLOROPHENOL, 2,4-	3.0E-03		1.00E+00	4.00E-01			1.00E-01	1.00E-01	0.32	6.70E-02	2 50E+03	Non-Odor
DICHLOROPROPANE, 1,2-		6.80E-02			1.00E+00	2.00E-01	2.00E-03	2.00E-03	168.00	4.20E+01	5 00E+02	Odor-1
DICHLOROPROPENE, 1,3-	3.0E-04	1.80E-01	1.00E+00	2.00E-01	1.00E+00	2.00E-01	3.00E-03	3.00E-03	43.00	4.30E+01	1.00E+03	Odor-2
DIELDRIN	5 0E-05	1.60E+01	1.00E+00	2.50E-01	1.00E+00	2.50E-01	5.00E-02	5 00E-02	0 00	1.80E-07	2 50E+03	Non-Odor

SOIL CATEGORY S-2	ORAL	ORAL										
DIRECT CONTACT LEVELS	RfD	CANCER	RAF_Ch	RAF_Ch	RAF_Ca	RAF_Ca	SOIL	SOIL	ODOR	VAPOR	CEILING	CEILING
	(or substitute)	POTENCY	SOIL	SOIL	SOIL	SOIL	BKGRND	MDL/PQL	INDEX	PRESSURE		BASIS
	mg/kg/day	FACTOR	INGEST	DERMAL	INGEST	DERMAL	mg/kg	mg/kg		Torr		
CHEMICAL PARAMETER		1/(mg/kg/day)								@ 20-30 C		
DIETHYL PHTHALATE	8.0E-01		1.00E+00	2.00E-02				6.60E-01	0.00		2.50E+03	Non-Odor
DIMETHYL PHTHALATE	1.0E+00		1.00E+00	7.00E-02				6.60E-01	0.00		2.50E+03	Non-Odor
DIMETHYLPHENOL, 2,4-	2 0E-02		1.00E+00	2.60E-01			2.00E-01	2 00E-01	0.00		2.50E+03	Non-Odor
DINITROPHENOL, 2,4-	2.0E-03		1.00E+00	2.60E-01			2 00E-01	2 00E-01	0.00		2.50E+03	Non-Odor
DINITROTOLUENE, 2,4-	2 0E-03	6.80E-01	1 00E+00	1.30E-01	1.00E+00	1.30E-01		6.60E-01	0.00	5.10E-03	2 50E+03	Non-Odor
ENDOSULFAN	6.0E-03		1.00E+00	2.00E-01				4.00E-02	0.00	1.00E-05	2.50E+03	Non-Odor
ENDRIN	3 0E-04		1.00E+00	2 50E-01			5.00E-02	5.00E-02	0.00	2.00E-07	2.50E+03	Non-Odor
ETHYLBENZENE	1.0E-01		1.00E+00	2 00E-01			2 00E-03	2 00E-03	4.35	1.00E+01	1.00E+03	Odor-2
ETHYLENE DIBROMIDE	2.0E-05	8.50E+01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.46	1.20E+01	5.00E+02	Volatility
FLUORANTHENE	4.0E-02		1.00E+00	2.00E-01			1.10E+00	5.00E-02	0.00	5.00E-06	2.50E+03	Non-Odor
FLUORENE	4.0E-02		1.00E+00	2 00E-01			1.20E-01	5.00E-02	0.00		2.50E+03	Non-Odor
HEPTACHLOR	5.0E-04	4.50E+00	1.00E+00	2 00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	0.02	3.00E-04	2.50E+03	Non-Odor
HEPTACHLOR EPOXIDE	1.3E-05	9.10E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	1.37E-04	2.60E-06	2.50E+03	Non-Odor
HEXACHLOROBENZENE	8 0E-04	1.60E+00	1.00E+00	1.30E-01	1.00E+00	1.30E-01		1.00E-02	0.00	1.09E-05	2.50E+03	Non-Odor
HEXACHLOROBUTADIENE	2.0E-03	7.80E-02	1.00E+00	2 00E-01	1.00E+00	2.00E-01		1.00E-02	1.17E-03	1.50E-01	2.50E+03	Non-Odor
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.0E-04	1.30E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01		1.00E-02	0.00	9.40E-06	2.50E+03	Non-Odor
HEXACHLOROETHANE	1.0E-03	1.40E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		1.00E-02	0.00	4.00E-01	2.50E+03	Non-Odor
INDENO(1,2,3-cd)PYRENE	4.0E-02	7.30E+00	9 10E-01	1 80E-01	1.00E+00	2.00E-01	3.80E-01	1.00E-01	0.00	1.00E-09	2.50E+03	Non-Odor
MERCURY	3.0E-04		1.00E+00	5 00E-02			2.30E-01	5.00E-02	0.00	1.20E-03	2.50E+03	Non-Odor
METHOXYCHLOR	5.0E-03		1.00E+00	2 00E-01			5.00E-02	5.00E-02	0.00	1.40E-06	2.50E+03	Non-Odor
METHYL ETHYL KETONE	6.0E-01		1.00E+00	1.00E-01				1.00E-01	9.09	1.00E+02	1.00E+03	Odor-2
METHYL ISOBUTYL KETONE	5.0E-02		1.00E+00	1 00E-01				5.00E-02	100.00	1.00E+01	5.00E+02	Odor-1
METHYL MERCURY	3.0E-04		1.00E+00	2 00E-01				0.00E+00	0.00		2.50E+03	Non-Odor
METHYL TERT BUTYL ETHER	5.2E-03		1.00E+00	1 00E-01				5.00E-02	0.00	2.45E+02	5.00E+02	Volatility
METHYLENE CHLORIDE	6.0E-02	7.50E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3.00E-03	3.00E-03	2.68	4.29E+02	1.00E+03	Odor-2
METHYLNAPHTHALENE, 2-	4.0E-02		1 00E+00	1.00E-01			2.50E+00	5.00E-02	0.00		2 50E+03	Non-Odor
MOLYBDENUM	5.0E-03		1.00E+00	1.00E-01			2.50E+00	2.50E+00	0.00		2.50E+03	Non-Odor
NAPHTHALENE	4.0E-02		1.00E+00	1.00E-01			9.00E-02	5.00E-02	0.98	8.20E-02	2.50E+03	Non-Odor
NICKEL	2.0E-02		1.00E+00	3 50E-01			4.30E+01	2.50E+00	0.00		2.50E+03	Non-Odor
PENTACHLOROPHENOL	3 0E-02	1.20E-01	1.00E+00	1.10E-01	1.00E+00	1.10E-01	1.00E-01	1.00E-01	0.00	1.10E-04	2.50E+03	Non-Odor
PHENANTHRENE	4.0E-02		9.10E-01	1.80E-01			6.90E-01	5.00E-02	2.40E-03	9 60E-04	2.50E+03	Non-Odor
PHENOL	6.0E-01		1.00E+00	2.60E-01			1.00E-01	1.00E-01	8.75	3.50E-01	1.00E+03	Odor-2
PYRENE	3.0E-02		1.00E+00	2.00E-01			1.00E+00	5.00E-02	0.00	2.50E-06	2.50E+03	Non-Odor
SELENIUM	5.0E-03		1.00E+00	2.00E-03			1.90E+00	1.00E+00	0.00		2.50E+03	Non-Odor
SILVER	5.0E-03		1.00E+00	2.50E-01			4.20E-01	2.50E-01	0.00		2.50E+03	Non-Odor
STYRENE	2.0E-01	3.00E-02	1.00E+00	2.00E-01	1.00E+00	2.00E-01	2.00E-03	2.00E-03	16.67	5.00E+00	1.00E+03	Odor-2
TETRACHLOROETHANE, 1,1,1,2-	3.0E-02	2.60E-02	1.00E+00	1.40E+00	1.00E+00	1.40E+00		5.00E-03	0.00	1.00E+01	5.00E+02	Volatility
TETRACHLOROETHANE, 1,1,2,2-		2 00E-01			1.00E+00	1.40E+00	4.00E-03	4.00E-03	2.67	4.00E+00	1.00E+03	Odor-2
TETRACHLOROETHYLENE	1.0E-02	5.20E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.08	1.90E+01	1.00E+03	Odor-2
THALLIUM	7.0E-05		1.00E+00	1.00E-02			2.50E+00	2.50E+00	0.00		2 50E+03	Non-Odor
TOLUENE	2.0E-01		1.00E+00	1.20E-01			2.00E-03	2.00E-03	3.50	2.80E+01	1.00E+03	Odor-2
TRICHLOROBENZENE, 1,2,4-	1.0E-02		1.00E+00	8.00E-02				6.60E-01	0.00		2.50E+03	Non-Odor
TRICHLOROETHANE, 1,1,1-	9.0E-02		1.00E+00	1.00E-01			9.00E-03	2 00E-03	0.83	1.00E+02	5.00E+02	Volatility
TRICHLOROETHANE, 1,1,2-	4 0E-03	5.70E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	2.00E-03	2.00E-03	0.00	2.50E+01	5.00E+02	Volatility
TRICHLOROETHYLENE	2.0E-03	1.10E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.01	7.70E+01	5.00E+02	Volatility
TRICHLOROPHENOL, 2,4,5-	1.0E-01		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		2.50E+03	Non-Odor
TRICHLOROPHENOL 2,4,6-		1.10E-02			1.00E+00	2.60E-01	3.00E-03	1.00E-01	0.00		2.50E+03	Non-Odor
VANADIUM	7.0E-03		5.00E-02	1.00E-01			9.10E+01	5.00E+00	0.00		2 50E+03	Non-Odor
VINYL CHLORIDE	1.0E-03	1.90E+00	1.00E+00	1.00E-01	1.53E+00	1.60E-01	2.00E-03	3.00E-03	0.66	2.58E+03	5.00E+02	Volatility
XYLENES (Mixed Isomers)	2.0E+00		1.00E+00	1.20E-01			2.00E-03	2.00E-03	60.00	6.00E+00	1.00E+03	Odor-2
ZINC	3.0E-01		1.00E+00	2.00E-02			1.60E+02	2.50E+01	0.00		2.50E+03	Non-Odor

SOIL CATEGORY S-2 DIRECT CONTACT LEVELS CHEMICAL PARAMETER	RISK-BASED NONCANCER H.I. = 2.00E-01 mg/kg	RISK-BASED CANCER ELCR = 1.00E-06 mg/kg	CANCER RISK-BASED CONC. 1.00E-06 mg/kg	LOWEST RISK-BASED CONCENTRATION mg/kg	HIGHEST RISK, MDL & BACKGROUND mg/kg	LOWEST CEILING, (RISK, MDL, BCKGRND) mg/kg	S-2 DIRECT CONTACT STANDARD mg/kg	BASIS
ACENAPHTHENE	3.6E+03	0.0E+00	0.00	3.6E+03	3.6E+03	2.50E+03	2500.00	Ceiling
ACENAPHTHYLENE	2.7E+03	0.0E+00	0.00	2.7E+03	2.7E+03	2.50E+03	2500.00	Ceiling
ACETONE	1.1E+04	0.0E+00	0.00	1.1E+04	1.1E+04	1.00E+03	1000.00	Ceiling
ALDRIN	1.5E+00	4.0E-02	0.04	4.0E-02	5.0E-02	5.00E-02	0.05	Background
ANTHRACENE	1.3E+04	0.0E+00	0.00	1.3E+04	1.3E+04	2.50E+03	2500.00	Ceiling
ANTIMONY	4.4E+01	0.0E+00	0.00	4.4E+01	4.4E+01	4.42E+01	44.20	Noncancer Risk
BARIUM	8.7E+03	0.0E+00	0.00	8.7E+03	8.7E+03	2.50E+03	2500.00	Ceiling
BENZENE	6.6E+02	6.3E+01	62.88	6.3E+01	6.3E+01	6.29E+01	62.88	Cancer Risk
BENZO(a)ANTHRACENE	2.7E+03	1.1E-01	0.11	1.1E-01	7.4E-01	7.40E-01	0.74	Background
BENZO(a)PYRENE	2.7E+03	1.1E-01	0.11	1.1E-01	4.9E-01	4.90E-01	0.49	Background
BENZO(b)FLUORANTHENE	2.7E+03	1.1E-01	0.11	1.1E-01	4.7E-01	4.70E-01	0.47	Background
BENZO(g,h,i)PERYLENE	2.7E+03	0.0E+00	0.00	2.7E+03	2.7E+03	2.50E+03	2500.00	Ceiling
BENZO(k)FLUORANTHENE	2.7E+03	1.1E-01	0.11	1.1E-01	4.8E-01	4.80E-01	0.48	Background
BERYLLIUM	1.3E+03	8.5E-01	0.85	8.5E-01	1.2E+00	1.20E+00	1.20	Background
BIPHENYL, 1,1-	6.6E+03	0.0E+00	0.00	6.6E+03	6.6E+03	2.50E+03	2500.00	Ceiling
BIS(2-CHLOROETHYL)ETHER	0.0E+00	1.6E-01	0.16	1.6E-01	6.6E-01	6.60E-01	0.66	PQL
BIS(2-CHLOROISOPROPYL)ETHER	5.2E+02	2.6E+00	2.56	2.6E+00	2.6E+00	2.56E+00	2.56	Cancer Risk
BIS(2-ETHYLHEXYL)PHTHALATE	6.7E+03	3.3E+02	325.27	3.3E+02	3.3E+02	3.25E+02	325.27	Cancer Risk
BROMODICHLOROMETHANE	2.2E+03	2.5E+01	24.51	2.5E+01	2.5E+01	2.45E+01	24.51	Cancer Risk
BROMOFORM	2.0E+03	1.9E+02	192.37	1.9E+02	1.9E+02	1.92E+02	192.37	Cancer Risk
BROMOMETHANE	1.5E+02	0.0E+00	0.00	1.5E+02	1.5E+02	1.55E+02	154.70	Noncancer Risk
CADMIUM	4.1E+01	0.0E+00	0.00	4.1E+01	4.1E+01	4.14E+01	41.40	Noncancer Risk
CARBON TETRACHLORIDE	7.7E+01	1.2E+01	11.69	1.2E+01	1.2E+01	1.17E+01	11.69	Cancer Risk
CHLORDANE	1.1E+01	2.0E+00	2.00	2.0E+00	2.0E+00	2.00E+00	2.00	Cancer Risk
CHLOROANILINE, p-	4.4E+02	0.0E+00	0.00	4.4E+02	4.4E+02	4.42E+02	441.99	Noncancer Risk
CHLOROBENZENE	2.2E+03	0.0E+00	0.00	2.2E+03	2.2E+03	1.00E+03	1000.00	Ceiling
CHLOROFORM	1.1E+03	2.5E+02	249.14	2.5E+02	2.5E+02	2.49E+02	249.14	Cancer Risk
CHLOROPHENOL, 2-	2.4E+02	0.0E+00	0.00	2.4E+02	2.4E+02	2.36E+02	235.74	Noncancer Risk
CHROMIUM(III)	2.2E+05	0.0E+00	0.00	2.2E+05	2.2E+05	2.50E+03	2500.00	Ceiling
CHROMIUM(VI)	6.0E+02	0.0E+00	0.00	6.0E+02	6.0E+02	6.03E+02	603.14	Noncancer Risk
CHRYSENE	2.7E+03	1.1E-01	0.11	1.1E-01	6.9E-01	6.90E-01	0.69	Background
COBALT	7.2E+03	0.0E+00	0.00	7.2E+03	7.2E+03	2.50E+03	2500.00	Ceiling
COPPER	3.4E+03	0.0E+00	0.00	3.4E+03	3.4E+03	2.50E+03	2500.00	Ceiling
CYANIDE	8.2E+02	0.0E+00	0.00	1.0E+02	1.0E+02	1.00E+02	100.00	Noncancer Risk
DIBENZO(a,h)ANTHRACENE	5.4E+03	2.3E-01	0.23	2.3E-01	2.3E-01	2.27E-01	0.23	Cancer Risk
DIBROMOCHLOROMETHANE	2.2E+03	1.8E+01	18.09	1.8E+01	1.8E+01	1.81E+01	18.09	Cancer Risk
DICHLOROBENZENE, 1,2- (o-DCB)	9.9E+03	0.0E+00	0.00	9.9E+03	9.9E+03	5.00E+02	500.00	Ceiling
DICHLOROBENZENE, 1,3- (m-DCB)	9.9E+03	0.0E+00	0.00	9.9E+03	9.9E+03	5.00E+02	500.00	Ceiling
DICHLOROBENZENE, 1,4- (p-DCB)	0.0E+00	6.3E+01	63.32	6.3E+01	6.3E+01	6.33E+01	63.32	Cancer Risk
DICHLOROBENZIDINE, 3,3'-	0.0E+00	7.2E-01	0.72	7.2E-01	1.3E+00	1.30E+00	1.30	PQL
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	0.0E+00	3.5E+00	3.45	3.5E+00	3.5E+00	3.45E+00	3.45	Cancer Risk
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	0.0E+00	2.4E+00	2.44	2.4E+00	2.4E+00	2.44E+00	2.44	Cancer Risk
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	3.0E+01	2.4E+00	2.44	2.4E+00	2.4E+00	2.44E+00	2.44	Cancer Risk
DICHLOROETHANE, 1,1-	8.5E+03	0.0E+00	0.00	8.5E+03	8.5E+03	5.00E+02	500.00	Ceiling
DICHLOROETHANE, 1,2-	2.2E+03	1.7E+01	16.70	1.7E+01	1.7E+01	1.67E+01	16.70	Cancer Risk
DICHLOROETHYLENE, 1,1-	9.9E+02	2.5E+00	2.48	2.5E+00	2.5E+00	2.48E+00	2.48	Cancer Risk
DICHLOROETHYLENE, CIS-1,2-	1.1E+03	0.0E+00	0.00	1.1E+03	1.1E+03	5.00E+02	500.00	Ceiling
DICHLOROETHYLENE, TRANS-1,2-	2.2E+03	0.0E+00	0.00	2.2E+03	2.2E+03	1.00E+03	1000.00	Ceiling
DICHLOROPHENOL, 2,4-	9.4E+01	0.0E+00	0.00	9.4E+01	9.4E+01	9.42E+01	94.19	Noncancer Risk
DICHLOROPROPANE, 1,2-	0.0E+00	1.2E+01	12.19	1.2E+01	1.2E+01	1.22E+01	12.19	Cancer Risk
DICHLOROPROPENE, 1,3-	1.8E+01	4.6E+00	4.61	4.6E+00	4.6E+00	4.61E+00	4.61	Cancer Risk
DIELDRIN	2.4E+00	4.2E-02	0.04	4.2E-02	5.0E-02	5.00E-02	0.05	Background

SOIL CATEGORY S-2	RISK-BASED	RISK-BASED	CANCER RISK-	LOWEST	HIGHEST	LOWEST	S-2	BASIS
DIRECT CONTACT LEVELS	NONCANCER	CANCER	BASED CONC.	RISK-BASED	RISK, MDL &	CEILING,	DIRECT CONTACT	
	H.I. =	ELCR =	1.00E-06	CONCENTRATION	BACKGROUND	(RISK, MDL,	STANDARD	
	2.00E-01	1.00E-06	mg/kg	mg/kg	mg/kg	BCKGRND)	mg/kg	
CHEMICAL PARAMETER	mg/kg	mg/kg				mg/kg		
DIETHYL PHTHALATE	2.7E+05	0.0E+00	0.00	2.7E+05	2.7E+05	2.50E+03	2500.00	Ceiling
DIMETHYL PHTHALATE	1.5E+05	0.0E+00	0.00	1.5E+05	1.5E+05	2.50E+03	2500.00	Ceiling
DIMETHYLPHENOL, 2,4-	9.4E+02	0.0E+00	0.00	9.4E+02	9.4E+02	9.43E+02	942.95	Noncancer Risk
DINITROPHENOL, 2,4-	9.4E+01	0.0E+00	0.00	9.4E+01	9.4E+01	9.43E+01	94.30	Noncancer Risk
DINITROTOLUENE, 2,4-	1.8E+02	1.8E+00	1.79	1.8E+00	1.8E+00	1.79E+00	1.79	Cancer Risk
ENDOSULFAN	3.6E+02	0.0E+00	0.00	3.6E+02	3.6E+02	3.60E+02	360.00	Noncancer Risk
ENDRIN	1.5E+01	0.0E+00	0.00	1.5E+01	1.5E+01	1.47E+01	14.67	Noncancer Risk
ETHYLBENZENE	6.0E+03	0.0E+00	0.00	6.0E+03	6.0E+03	1.00E+03	1000.00	Ceiling
ETHYLENE DIBROMIDE	2.2E+00	1.8E-02	0.02	1.8E-02	1.8E-02	1.79E-02	0.02	Cancer Risk
FLUORANTHENE	2.4E+03	0.0E+00	0.00	2.4E+03	2.4E+03	2.40E+03	2402.40	Noncancer Risk
FLUORENE	2.4E+03	0.0E+00	0.00	2.4E+03	2.4E+03	2.40E+03	2402.40	Noncancer Risk
HEPTACHLOR	3.0E+01	1.8E-01	0.18	1.8E-01	1.8E-01	1.84E-01	0.18	Cancer Risk
HEPTACHLOR EPOXIDE	7.8E-01	9.1E-02	0.09	9.1E-02	9.1E-02	9.11E-02	0.09	Cancer Risk
HEXACHLOROBENZENE	7.1E+01	7.6E-01	0.76	7.6E-01	7.6E-01	7.60E-01	0.76	Cancer Risk
HEXACHLOROBUTADIENE	1.2E+02	1.1E+01	10.63	1.1E+01	1.1E+01	1.06E+01	10.63	Cancer Risk
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	1.8E+01	6.4E-01	0.64	6.4E-01	6.4E-01	6.38E-01	0.64	Cancer Risk
HEXACHLOROETHANE	1.3E+01	1.3E+01	12.78	1.3E+01	1.3E+01	1.28E+01	12.78	Cancer Risk
INDENO(1,2,3-cd)PYRENE	2.7E+03	1.1E-01	0.11	1.1E-01	3.8E-01	3.80E-01	0.38	Background
MERCURY	5.7E+01	0.0E+00	0.00	5.7E+01	5.7E+01	5.71E+01	57.14	Noncancer Risk
METHOXYCHLOR	3.0E+02	0.0E+00	0.00	3.0E+02	3.0E+02	3.00E+02	300.30	Noncancer Risk
METHYL ETHYL KETONE	6.6E+04	0.0E+00	0.00	6.6E+04	6.6E+04	1.00E+03	1000.00	Ceiling
METHYL ISOBUTYL KETONE	5.5E+03	0.0E+00	0.00	5.5E+03	5.5E+03	5.00E+02	500.00	Ceiling
METHYL MERCURY	1.8E+01	0.0E+00	0.00	1.8E+01	1.8E+01	1.80E+01	18.02	Noncancer Risk
METHYL TERT BUTYL ETHER	5.7E+02	0.0E+00	0.00	5.7E+02	5.7E+02	5.00E+02	500.00	Ceiling
METHYLENE CHLORIDE	6.6E+03	2.0E+02	202.63	2.0E+02	2.0E+02	2.03E+02	202.63	Cancer Risk
METHYLNAPHTHALENE, 2-	4.4E+03	0.0E+00	0.00	4.4E+03	4.4E+03	2.50E+03	2500.00	Ceiling
MOLYBDENUM	5.5E+02	0.0E+00	0.00	5.5E+02	5.5E+02	5.52E+02	552.00	Noncancer Risk
NAPHTHALENE	4.4E+03	0.0E+00	0.00	4.4E+03	4.4E+03	2.50E+03	2500.00	Ceiling
NICKEL	7.1E+02	0.0E+00	0.00	7.1E+02	7.1E+02	7.13E+02	713.01	Noncancer Risk
PENTACHLOROPHENOL	3.1E+03	1.2E+01	11.69	1.2E+01	1.2E+01	1.17E+01	11.69	Cancer Risk
PHENANTHRENE	2.7E+03	0.0E+00	0.00	2.7E+03	2.7E+03	2.50E+03	2500.00	Ceiling
PHENOL	2.8E+04	0.0E+00	0.00	2.8E+04	2.8E+04	1.00E+03	1000.00	Ceiling
PYRENE	1.8E+03	0.0E+00	0.00	1.8E+03	1.8E+03	1.80E+03	1801.80	Noncancer Risk
SELENIUM	3.1E+03	0.0E+00	0.00	3.1E+03	3.1E+03	2.50E+03	2500.00	Ceiling
SILVER	2.4E+02	0.0E+00	0.00	2.4E+02	2.4E+02	2.44E+02	244.50	Noncancer Risk
STYRENE	1.2E+04	2.8E+01	27.64	2.8E+01	2.8E+01	2.76E+01	27.64	Cancer Risk
TETRACHLOROETHANE, 1,1,1,2-	2.8E+02	4.9E+00	4.94	4.9E+00	4.9E+00	4.94E+00	4.94	Cancer Risk
TETRACHLOROETHANE, 1,1,2,2-	0.0E+00	6.4E-01	0.64	6.4E-01	6.4E-01	6.43E-01	0.64	Cancer Risk
TETRACHLOROETHYLENE	1.1E+03	2.9E+02	292.26	2.9E+02	2.9E+02	2.92E+02	292.26	Cancer Risk
THALLIUM	3.2E+01	0.0E+00	0.00	3.2E+01	3.2E+01	3.17E+01	31.67	Noncancer Risk
TOLUENE	1.9E+04	0.0E+00	0.00	1.9E+04	1.9E+04	1.00E+03	1000.00	Ceiling
TRICHLOROBENZENE, 1,2,4-	1.3E+03	0.0E+00	0.00	1.3E+03	1.3E+03	1.33E+03	1328.02	Noncancer Risk
TRICHLOROETHANE, 1,1,1-	9.9E+03	0.0E+00	0.00	9.9E+03	9.9E+03	5.00E+02	500.00	Ceiling
TRICHLOROETHANE, 1,1,2-	5.2E+01	3.1E+00	3.14	3.1E+00	3.1E+00	3.14E+00	3.14	Cancer Risk
TRICHLOROETHYLENE	2.2E+02	1.4E+02	138.16	1.4E+02	1.4E+02	1.38E+02	138.16	Cancer Risk
TRICHLOROPHENOL, 2,4,5-	4.7E+03	0.0E+00	0.00	4.7E+03	4.7E+03	2.50E+03	2500.00	Ceiling
TRICHLOROPHENOL 2,4,6-	0.0E+00	5.9E+01	59.23	5.9E+01	5.9E+01	5.92E+01	59.23	Cancer Risk
VANADIUM	9.1E+02	0.0E+00	0.00	9.1E+02	9.1E+02	9.12E+02	912.00	Noncancer Risk
VINYL CHLORIDE	1.1E+02	5.0E-01	0.50	5.0E-01	5.0E-01	5.04E-01	0.50	Cancer Risk
XYLENES (Mixed Isomers)	1.9E+05	0.0E+00	0.00	1.9E+05	1.9E+05	1.00E+03	1000.00	Ceiling
ZINC	1.0E+05	0.0E+00	0.00	1.0E+05	1.0E+05	2.50E+03	2500.00	Ceiling

Appendix B.1.3: Derivation of Direct Contact S-3 Soil Concentrations

SOIL CATEGORY S-3	ORAL	ORAL										
DIRECT CONTACT LEVELS	RID	CANCER	RAF_Ch	RAF_Ch	RAF_Ca	RAF_Ca	SOIL	SOIL	ODOR	VAPOR	CEILING	CEILING
	(or substitute)	POTENCY	SOIL	SOIL	SOIL	SOIL	BKGRND	MDL/PQL	INDEX	PRESSURE		BASIS
	mg/kg/day	FACTOR	INGEST	DERMAL	INGEST	DERMAL	mg/kg	mg/kg		Torr		
CHEMICAL PARAMETER		1/(mg/kg/day)								@ 20-30 C		
ACENAPHTHENE	6.0E-01		1.00E+00	2.00E-01			7.00E-02	5.00E-02	0.00		5.00E+03	Non-Odor
ACENAPHTHYLENE	4.0E-02		9.10E-01	1.80E-01			8.00E-02	5.00E-02	0.00	2.90E-02	5.00E+03	Non-Odor
ACETONE	1.0E+00		1.00E+00	1.00E-01				1.00E-01	20.77	2.70E+02	2.50E+03	Odor-2
ALDRIN	3.0E-05	1.70E+01	1.00E+00	2.50E-01	1.00E+00	2.50E-01	5.00E-02	5.00E-02	5.87E-06	2.30E-05	5.00E+03	Non-Odor
ANTHRACENE	3.0E+00		1.00E+00	2.90E-01			1.60E-01	5.00E-02	0.00	1.70E-05	5.00E+03	Non-Odor
ANTIMONY	4.0E-04		1.00E+00	1.00E-01			1.00E+00	1.00E+00	0.00		5.00E+03	Non-Odor
BARIUM	7.0E-02		3.00E-01	1.00E-01			2.10E+02	2.50E+00	0.00		5.00E+03	Non-Odor
BENZENE	5.0E-02	2.90E-02	1.00E+00	8.00E-02	1.00E+00	8.00E-02	2.00E-03	2 00E-03	63.33	9.50E+01	2.50E+03	Odor-2
BENZO(a)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	7.40E-01	5.00E-02	0.00	5.00E-09	5.00E+03	Non-Odor
BENZO(a)PYRENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.90E-01	5.00E-02	0.00	5.00E-09	5.00E+03	Non-Odor
BENZO(b)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.70E+00	5.00E-02	0.00		5.00E+03	Non-Odor
BENZO(g,h,i)PERYLENE	4.0E-02		9.10E-01	1.80E-01			6.80E-01	1.00E-01	0.00	1.00E-10	5.00E+03	Non-Odor
BENZO(k)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	4.80E-01	5.00E-02	0.00	9.59E-11	5.00E+03	Non-Odor
BERYLLIUM	5.0E-03	4.30E+00	1.00E+00	3.00E-02	1.00E+00	3.00E-02	1.20E+00	5.00E-01	0.00		5.00E+03	Non-Odor
BIPHENYL, 1,1-	5.0E-02		1.00E+00	8.00E-02				5.00E-02	0.00		5.00E+03	Non-Odor
BIS(2-CHLOROETHYL)ETHER		1.10E+00			1.00E+00	1.00E+00		6.60E-01	14.49	7.10E-01	2.50E+03	Odor-2
BIS(2-CHLOROISOPROPYL)ETHER	4.0E-02	7.00E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		6.60E-01	2.66	8.50E-01	2.50E+03	Odor-2
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E-02	1.40E-02	1.00E+00	2.00E-02	1.00E+00	2.00E-02		6 60E-01	0.00		5.00E+03	Non-Odor
BROMODICHLOROMETHANE	2.0E-02	6 20E-02	1 00E+00	1.00E-01	1.00E+00	1.00E-01		5.00E-03	0 00	5.00E+01	5.00E+02	Volatility
BROMOFORM	2.0E-01	7.90E-03	1.00E+00	1.10E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.31	5.60E+00	2.50E+03	Odor-2
BROMOMETHANE	1.4E-02		1.00E+00	1.00E-01			3.00E-03	3.00E-03	71.00	1.42E+03	2.50E+03	Odor-2
CADMIUM	5.0E-04		1.00E+00	1.40E-01			1.00E+00	1.00E+00	0.00		5.00E+03	Non-Odor
CARBON TETRACHLORIDE	7.0E-03	1.30E-01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	11 30	1.13E+02	2.50E+03	Odor-2
CHLORDANE	6.0E-05	1.30E+00	1.00E+00	5.00E-02	1.00E+00	5.00E-02	5.00E-02	5.00E-02	7.12E-05	1.00E-05	5.00E+03	Non-Odor
CHLOROANILINE, p-	4.0E-03		1.00E+00	1.00E-01				1.30E+00	0.00	1.50E-02	5.00E+03	Non-Odor
CHLOROBENZENE	2 0E-01		1.00E+00	1 00E-01			2 00E-03	2.00E-03	53.64	1.18E+01	2.50E+03	Odor-2
CHLOROFORM	1.0E-02	6.10E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	6.00E-03	2.00E-03	1.88	1.60E+02	2.50E+03	Odor-2
CHLOROPHENOL, 2-	5.0E-02		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		5.00E+03	Non-Odor
CHROMIUM(III)	1.0E+00		1.00E+00	4.00E-02			7.10E+01	1.40E+00	0.00		5.00E+03	Non-Odor
CHROMIUM(VI)	2.0E-02		1.00E+00	9.00E-02			2.50E+00	2.50E+00	0.00		5.00E+03	Non-Odor
CHRYSENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	6.90E-01	5.00E-02	0.00	6.30E-09	5.00E+03	Non-Odor
COBALT	6.0E-02		5.00E-01	1.00E-01			2.10E+01	2 50E+00	0.00		5.00E+03	Non-Odor
COPPER	3.0E-02		9.00E-01	1.00E-01			8.50E+01	5.00E+00	0.00		5.00E+03	Non-Odor
CYANIDE	2.0E-02		1.00E+00	3.00E-01			1.20E-01	5.00E-02	1068.97	6.20E+02	1.00E+03	Odor-1
DIBENZO(a,h)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	8.00E-02	1 00E+00	9.00E-02	1.60E-01	1.00E-01	0.00	1.00E-10	5.00E+03	Non-Odor
DIBROMOCHLOROMETHANE	2.0E-01	8 40E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3.00E-03	3 00E-03	0.00	7.60E+01	5.00E+02	Volatility
DICHLOROBENZENE, 1,2- (o-DCB)	9.0E-01		1.00E+00	1.00E-01			2.00E-03	2.00E-03	0.03	1.50E+00	5.00E+02	Volatility
DICHLOROBENZENE, 1,3- (m-DCB)	9.0E-01		1.00E+00	1.00E-01			2.00E-03	2.00E-03	0.03	1.50E+00	5 00E+02	Volatility(o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)	9.0E-01	2.40E-02	1 00E+00	1.00E-01	1.00E+00	1.00E-01	2 00E-03	2.00E-03	10.00	1.80E+00	2 50E+03	Odor-2
DICHLOROBENZIDINE, 3,3'-		4.50E-01			1.00E+00	5.40E-01		1.30E+00	0.00	4 50E-09	5.00E+03	Non-Odor
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)		2.40E-01			1.00E+00	2.00E-01		5.00E-02	0.00	1.00E-06	5.00E+03	Non-Odor
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)		3 40E-01			1.00E+00	2.00E-01		1.00E-02	0.00	6.50E-06	5.00E+03	Non-Odor
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	5 0E-04	3 40E-01	1.00E+00	2.00E-01	1.00E+00	2.00E-01	1.40E+00	5.00E-02	0.00	1.50E-07	5 00E+03	Non-Odor
DICHLOROETHANE, 1,1-	1.0E+00		1.30E+00	1.30E-01			2.00E-03	2 00E-03	0.47	2.34E+02	5.00E+02	Volatility
DICHLOROETHANE, 1,2-	2.0E-01	9.10E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	13.17	7.90E+01	2.50E+03	Odor-2
DICHLOROETHYLENE, 1,1-	9.0E-03	6.00E-01	1.00E+00	1.00E-01	1.02E+00	1.02E-01	2.00E-03	2 00E-03	1.18	5 91E+02	2.50E+03	Odor-2
DICHLOROETHYLENE, CIS-1,2-	1.0E-01		1.00E+00	1.00E-01				5.00E-03	0.00	2.02E+02	5.00E+02	Volatility
DICHLOROETHYLENE, TRANS-1,2-	2.0E-01		1.00E+00	1.00E-01			3.00E-03	3.00E-03	19.47	3 31E+02	2.50E+03	Odor-2
DICHLOROPHENOL, 2,4-	3.0E-03		1.00E+00	4.00E-01			1.00E-01	1.00E-01	0.32	6.70E-02	5.00E+03	Non-Odor
DICHLOROPROPANE, 1,2-		6 80E-02			1.00E+00	2.00E-01	2.00E-03	2.00E-03	168.00	4.20E+01	1.00E+03	Odor-1
DICHLOROPROPENE, 1,3-	3.0E-03	1.80E-01	1.00E+00	2.00E-01	1.00E+00	2.00E-01	3.00E-03	3.00E-03	43.00	4.30E+01	2.50E+03	Odor-2
DIELDRIN	5.0E-05	1.60E+01	1.00E+00	2.50E-01	1 00E+00	2.50E-01	5.00E-02	5 00E-02	0.00	1.80E-07	5.00E+03	Non-Odor

SOIL CATEGORY S-3 DIRECT CONTACT LEVELS	ORAL RfD (or substitute) mg/kg/day	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	RAF_Ch SOIL INGEST	RAF_Ch SOIL DERMAL	RAF_Ca SOIL INGEST	RAF_Ca SOIL DERMAL	SOIL BKGRND mg/kg	SOIL MDL/PQL mg/kg	ODOR INDEX	VAPOR PRESSURE Torr @ 20-30 C	CEILING	CEILING BASIS
CHEMICAL PARAMETER												
DIETHYL PHTHALATE	8.0E+00		1.00E+00	2.00E-02				6.60E-01	0.00		5.00E+03	Non-Odor
DIMETHYL PHTHALATE	1.0E+00		1.00E+00	7.00E-02				6.60E-01	0.00		5.00E+03	Non-Odor
DIMETHYLPHENOL, 2,4-	2.0E-01		1.00E+00	2.60E-01			2.00E-01	2.00E-01	0.00		5.00E+03	Non-Odor
DINITROPHENOL, 2,4-	2.0E-03		1.00E+00	2.60E-01			2.00E-01	2.00E-01	0.00		5.00E+03	Non-Odor
DINITROTOLUENE, 2,4-	2.0E-03	6.80E-01	1.00E+00	1.30E-01	1.00E+00	1.30E-01		6.60E-01	0.00	5.10E-03	5.00E+03	Non-Odor
ENDOSULFAN	6.0E-03		1.00E+00	2.00E-01				4.00E-02	0.00	1.00E-05	5.00E+03	Non-Odor
ENDRIN	3.0E-04		1.00E+00	2.50E-01			5.00E-02	5.00E-02	0.00	2.00E-07	5.00E+03	Non-Odor
ETHYLBENZENE	1.0E+00		1.00E+00	2.00E-01			2.00E-03	2.00E-03	4.35	1.00E+01	2.50E+03	Odor-2
ETHYLENE DIBROMIDE	2.0E-04	8.50E+01	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.46	1.20E+01	5.00E+02	Volatility
FLUORANTHENE	4.0E-01		1.00E+00	2.00E-01			1.10E+00	5.00E-02	0.00	5.00E-06	5.00E+03	Non-Odor
FLUORENE	4.0E-01		1.00E+00	2.00E-01			1.20E-01	5.00E-02	0.00		5.00E+03	Non-Odor
HEPTACHLOR	5.0E-04	4.50E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	0.02	3.00E-04	5.00E+03	Non-Odor
HEPTACHLOR EPOXIDE	1.3E-05	9.10E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01	5.00E-02	5.00E-02	1.37E-04	2.60E-08	5.00E+03	Non-Odor
HEXACHLOROBENZENE	8.0E-04	1.60E+00	1.00E+00	1.30E-01	1.00E+00	1.30E-01		1.00E-02	0.00	1.09E-05	5.00E+03	Non-Odor
HEXACHLOROBUTADIENE	2.0E-03	7.80E-02	1.00E+00	2.00E-01	1.00E+00	2.00E-01		1.00E-02	1.17E-03	1.50E-01	5.00E+03	Non-Odor
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.0E-03	1.30E+00	1.00E+00	2.00E-01	1.00E+00	2.00E-01		1.00E-02	0.00	9.40E-06	5.00E+03	Non-Odor
HEXACHLOROETHANE	1.0E-02	1.40E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00		1.00E-02	0.00	4.00E-01	5.00E+03	Non-Odor
INDENO(1,2,3-cd)PYRENE	4.0E-02	7.30E+00	9.10E-01	1.80E-01	1.00E+00	2.00E-01	3.80E-01	1.00E-01	0.00	1.00E-09	5.00E+03	Non-Odor
MERCURY	3.0E-04		1.00E+00	5.00E-02			2.30E-01	5.00E-02	0.00	1.20E-03	5.00E+03	Non-Odor
METHOXYCHLOR	5.0E-03		1.00E+00	2.00E-01			5.00E-02	5.00E-02	0.00	1.40E-06	5.00E+03	Non-Odor
METHYL ETHYL KETONE	5.0E-01		1.00E+00	1.00E-01				1.00E-01	9.09	1.00E+02	2.50E+03	Odor-2
METHYL ISOBUTYL KETONE	5.0E-01		1.00E+00	1.00E-01				5.00E-02	100.00	1.00E+01	1.00E+03	Odor-1
METHYL MERCURY	3.0E-04		1.00E+00	2.00E-01				0.00E+00	0.00		5.00E+03	Non-Odor
METHYL TERT BUTYL ETHER	5.2E-02		1.00E+00	1.00E-01				5.00E-02	0.00	2.45E+02	5.00E+02	Volatility
METHYLENE CHLORIDE	6.0E-02	7.50E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	3.00E-03	3.00E-03	2.68	4.29E+02	2.50E+03	Odor-2
METHYLNAPHTHALENE, 2-	4.0E-02		1.00E+00	1.00E-01			2.50E+00	5.00E-02	0.00		5.00E+03	Non-Odor
MOLYBDENUM	5.0E-03		1.00E+00	1.00E-01			2.50E+00	2.50E+00	0.00		5.00E+03	Non-Odor
NAPHTHALENE	4.0E-02		1.00E+00	1.00E-01			9.00E-02	5.00E-02	0.98	8.20E-02	5.00E+03	Non-Odor
NICKEL	2.0E-02		1.00E+00	3.50E-01			4.30E+01	2.50E+00	0.00		5.00E+03	Non-Odor
PENTACHLOROPHENOL	3.0E-02	1.20E-01	1.00E+00	1.10E-01	1.00E+00	1.10E-01	1.00E-01	1.00E-01	0.00	1.10E-04	5.00E+03	Non-Odor
PHENANTHRENE	4.0E-02		9.10E-01	1.80E-01			6.80E-01	5.00E-02	2.40E-03	9.60E-04	5.00E+03	Non-Odor
PHENOL	6.0E-01		1.00E+00	2.60E-01			1.00E-01	1.00E-01	8.75	3.50E-01	2.50E+03	Odor-2
PYRENE	3.0E-01		1.00E+00	2.00E-01			1.00E+00	5.00E-02	0.00	2.50E-06	5.00E+03	Non-Odor
SELENIUM	5.0E-03		1.00E+00	2.00E-03			1.90E+00	1.00E+00	0.00		5.00E+03	Non-Odor
SILVER	5.0E-03		1.00E+00	2.50E-01			4.20E-01	2.50E-01	0.00		5.00E+03	Non-Odor
STYRENE	2.0E+00	3.00E-02	1.00E+00	2.00E-01	1.00E+00	2.00E-01	2.00E-03	2.00E-03	16.67	5.00E+00	2.50E+03	Odor-2
TETRACHLOROETHANE, 1,1,1,2-	3.0E-02	2.60E-02	1.00E+00	1.40E+00	1.00E+00	1.40E+00		5.00E-03	0.00	1.00E+01	5.00E+02	Volatility
TETRACHLOROETHANE, 1,1,2,2-		2.00E-01			1.00E+00	1.40E+00	4.00E-03	4.00E-03	2.67	4.00E+00	2.50E+03	Odor-2
TETRACHLOROETHYLENE	1.0E-01	5.20E-03	1.00E+00	1.00E-01	1.00E+00	1.00E-01	2.00E-03	2.00E-03	4.08	1.90E+01	2.50E+03	Odor-2
THALLIUM	7.0E-04		1.00E+00	1.00E-02			2.50E+00	2.50E+00	0.00		5.00E+03	Non-Odor
TOLUENE	2.0E+00		1.00E+00	1.20E-01			2.00E-03	2.00E-03	3.50	2.80E+01	2.50E+03	Odor-2
TRICHLOROBENZENE, 1,2,4-	1.0E-02		1.00E+00	8.00E-02				6.60E-01	0.00		5.00E+03	Non-Odor
TRICHLOROETHANE, 1,1,1-	9.0E-01		1.00E+00	1.00E-01			9.00E-03	2.00E-03	0.63	1.00E+02	5.00E+02	Volatility
TRICHLOROETHANE, 1,1,2-	4.0E-02	5.70E-02	1.00E+00	1.00E+00	1.00E+00	1.00E+00	2.00E-03	2.00E-03	0.00	2.50E+01	5.00E+02	Volatility
TRICHLOROETHYLENE	2.0E-02	1.10E-02	1.00E+00	1.00E-01	1.00E+00	1.00E-01	4.00E-03	4.00E-03	0.01	7.70E+01	5.00E+02	Volatility
TRICHLOROPHENOL, 2,4,5-	1.0E+00		1.00E+00	2.60E-01			1.00E-01	1.00E-01	0.00		5.00E+03	Non-Odor
TRICHLOROPHENOL 2,4,6-		1.10E-02			1.00E+00	2.60E-01	1.00E-01	1.00E-01	0.00		5.00E+03	Non-Odor
VANADIUM	7.0E-03		5.00E-02	1.00E-01			9.10E+01	5.00E+00	0.00		5.00E+03	Non-Odor
VINYL CHLORIDE	1.0E-03	1.90E+00	1.00E+00	1.00E-01	1.53E+00	1.60E-01	3.00E-03	3.00E-03	0.86	2.58E+03	5.00E+02	Volatility
XYLENES (Mixed Isomers)	4.0E+00		1.00E+00	1.20E-01			2.00E-03	2.00E-03	60.00	8.00E+00	2.50E+03	Odor-2
ZINC	3.0E-01		1.00E+00	2.00E-02			1.60E+02	2.50E+01	0.00		5.00E+03	Non-Odor

SOIL CATEGORY S-3 DIRECT CONTACT LEVELS CHEMICAL PARAMETER	RISK-BASED NONCANCER H.I. = 2.00E-01 mg/kg	RISK-BASED CANCER ELCR= 1.00E-06 mg/kg	CANCER RISK-BASED CONC. 1.00E-06 mg/kg	LOWEST RISK-BASED CONCENTRATION mg/kg	HIGHEST RISK, MDL & BACKGROUND mg/kg	LOWEST CEILING, (RISK, MDL, BCKGRND) mg/kg	S-2 STANDARD FROM S-2 SPREADSHEET (RAW) mg/kg	HIGHEST CALCULATED S-2 OR S-3 STANDARD mg/kg
ACENAPHTHENE	1.7E+04	0.0E+00	0.00	1.7E+04	1.7E+04	5.00E+03	2.50E+03	5 00E+03
ACENAPHTHYLENE	1.2E+03	0.0E+00	0.00	1.2E+03	1.2E+03	1.25E+03	2.50E+03	2.50E+03
ACETONE	5.2E+04	0.0E+00	0.00	5.2E+04	5.2E+04	2.50E+03	1.00E+03	2.50E+03
ALDRIN	6.9E-01	1.5E-01	0.15	1.5E-01	1.5E-01	1.46E-01	5.00E-02	1.46E-01
ANTHRACENE	6 0E+04	0.0E+00	0.00	6.0E+04	6.0E+04	5.00E+03	2.50E+03	5.00E+03
ANTIMONY	2.1E+01	0.0E+00	0.00	2.1E+01	2.1E+01	2.06E+01	4.42E+01	4.42E+01
BARIUM	4.1E+03	0.0E+00	0.00	4.1E+03	4.1E+03	4.07E+03	2.50E+03	4.07E+03
BENZENE	3.1E+03	2.3E+02	231.43	2.3E+02	2.3E+02	2.31E+02	6.29E+01	2.31E+02
BENZO(a)ANTHRACENE	1.2E+03	4.2E-01	0.42	4.2E-01	7.4E-01	7.40E-01	7.40E-01	7.40E-01
BENZO(a)PYRENE	1.2E+03	4.2E-01	0.42	4.2E-01	4.9E-01	4.90E-01	4.90E-01	4.90E-01
BENZO(b)FLUORANTHENE	1.2E+03	4.2E-01	0.42	4.2E-01	4.7E+00	4.70E+00	4.70E-01	4.70E+00
BENZO(g,h,i)PERYLENE	1.2E+03	0.0E+00	0.00	1.2E+03	1.2E+03	1.25E+03	2.50E+03	2.50E+03
BENZO(k)FLUORANTHENE	1.2E+03	4.2E-01	0.42	4.2E-01	4.8E-01	4.80E-01	4.80E-01	4.80E-01
BERYLLIUM	6 2E+02	3.1E+00	3.14	3.1E+00	3.1E+00	3.14E+00	1.20E+00	3.14E+00
BIPHENYL, 1,1-	3.1E+03	0.0E+00	0.00	3.1E+03	3.1E+03	3.10E+03	2.50E+03	3.10E+03
BIS(2-CHLOROETHYL)ETHER	0.0E+00	5.9E-01	0.59	5.9E-01	6.6E-01	6.60E-01	6.60E-01	6.60E-01
BIS(2-CHLOROISOPROPYL)ETHER	2.4E+02	9.3E+00	9.34	9.3E+00	9.3E+00	9.34E+00	2.56E+00	9.34E+00
BIS(2-ETHYLHEXYL)PHTHALATE	3.1E+03	1.2E+03	1210.65	1.2E+03	1.2E+03	1.21E+03	3.25E+02	1.21E+03
BROMODICHLOROMETHANE	1.0E+03	9.0E+01	90.11	9.0E+01	9.0E+01	9.01E+01	2.45E+01	9.01E+01
BROMOFORM	9 5E+03	7.1E+02	707.16	7.1E+02	7.1E+02	7.07E+02	1.92E+02	7.07E+02
BROMOMETHANE	7.2E+02	0.0E+00	0.00	7.2E+02	7.2E+02	7.22E+02	1.55E+02	7.22E+02
CADMIUM	1.9E+01	0.0E+00	0.00	1.9E+01	1.9E+01	1.93E+01	4.14E+01	4.14E+01
CARBON TETRACHLORIDE	3.6E+02	4.3E+01	42.97	4 3E+01	4.3E+01	4.30E+01	1.17E+01	4.30E+01
CHLORDANE	5 3E+00	7.4E+00	7.40	5.3E+00	5.3E+00	5.32E+00	2.00E+00	5.32E+00
CHLOROANILINE, p-	2.1E+02	0.0E+00	0.00	2.1E+02	2.1E+02	2.06E+02	4.42E+02	4.42E+02
CHLOROBENZENE	1.0E+04	0 0E+00	0.00	1.0E+04	1.0E+04	2 50E+03	1.00E+03	2.50E+03
CHLOROFORM	5 2E+02	9.2E+02	915 83	5 2E+02	5.2E+02	5.15E+02	2.49E+02	5.15E+02
CHLOROPHENOL, 2-	1.1E+03	0.0E+00	0.00	1.1E+03	1.1E+03	1.10E+03	2.38E+02	1.10E+03
CHROMIUM(III)	1.0E+05	0.0E+00	0.00	1.0E+05	1.0E+05	5.00E+03	2.50E+03	5.00E+03
CHROMIUM(VI)	1.1E+03	0.0E+00	0.00	1.1E+03	1.1E+03	1.13E+03	6.03E+02	1.13E+03
CHRYSENE	1 2E+03	4.2E-01	0.42	4.2E-01	6.9E-01	6.90E-01	6.90E-01	6.90E-01
COBALT	3.4E+03	0.0E+00	0.00	3.4E+03	3.4E+03	3.37E+03	2.50E+03	3.37E+03
COPPER	1.6E+03	0 0E+00	0.00	1.6E+03	1.6E+03	1.57E+03	2.50E+03	2.50E+03
CYANIDE	3.9E+02	0.0E+00	0.00	3.9E+02	3.9E+02	3.85E+02	4.50E-02	3.85E+02
DIBENZO(a,h)ANTHRACENE	2 5E+03	8.4E-01	0 84	8 4E-01	8.4E-01	8.35E-01	2.30E-01	8.35E-01
DIBROMOCHLOROMETHANE	1.0E+04	6.7E+01	66.51	6.7E+01	6.7E+01	6.65E+01	1.81E+01	6.65E+01
DICHLOROBENZENE, 1,2- (o-DCB)	4 6E+04	0 0E+00	0 00	4 6E+04	4.6E+04	5.00E+02	5 00E+02	5.00E+02
DICHLOROBENZENE, 1,3- (m-DCB)	4 6E+04	0.0E+00	0 00	4 6E+04	4 6E+04	5.00E+02	5 00E+02	5.00E+02
DICHLOROBENZENE, 1,4- (p-DCB)	4 6E+04	2 3E+02	232 77	2 3E+02	2 3E+02	2 33E+02	6.33E+01	2.33E+02
DICHLOROBENZIDINE, 3,3'-	0 0E+00	2 6E+00	2.65	2.6E+00	2.6E+00	2 65E+00	1.30E+00	2.65E+00
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	0 0E+00	1 3E+01	12 66	1 3E+01	1.3E+01	1.27E+01	3.45E+00	1.27E+01
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	0 0E+00	8 9E+00	8 94	8.9E+00	8.9E+00	8 94E+00	2.44E+00	8.94E+00
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	1.4E+01	8 9E+00	8.94	8.9E+00	8.9E+00	8.94E+00	2.44E+00	8.94E+00
DICHLOROETHANE, 1,1-	4.0E+04	0.0E+00	0 00	4.0E+04	4.0E+04	5.00E+02	5.00E+02	5.00E+02
DICHLOROETHANE, 1,2-	1.0E+04	6 1E+01	61.39	6.1E+01	6.1E+01	6.14E+01	1.67E+01	6.14E+01
DICHLOROETHYLENE, 1,1-	4.6E+02	9.1E+00	9.13	9.1E+00	9.1E+00	9.13E+00	2.48E+00	9.13E+00
DICHLOROETHYLENE, CIS-1,2-	5.2E+03	0 0E+00	0.00	5.2E+03	5.2E+03	5.00E+02	5.00E+02	5.00E+02
DICHLOROETHYLENE, TRANS-1,2-	1.0E+04	0.0E+00	0.00	1.0E+04	1.0E+04	2.50E+03	1.00E+03	2.50E+03
DICHLOROPHENOL, 2,4-	4 4E+01	0.0E+00	0.00	4.4E+01	4.4E+01	4.40E+01	9.42E+01	9.42E+01
DICHLOROPROPANE, 1,2-	0.0E+00	4 5E+01	44.70	4.5E+01	4.5E+01	4.47E+01	1.22E+01	4.47E+01
DICHLOROPROPENE, 1,3-	8.4E+01	1.7E+01	16.89	1.7E+01	1.7E+01	1.69E+01	4.61E+00	1.69E+01
DIELDRIN	1.1E+00	1.5E-01	0.15	1.5E-01	1.5E-01	1.55E-01	5.00E-02	1.55E-01

SOIL CATEGORY S-3 DIRECT CONTACT LEVELS CHEMICAL PARAMETER	RISK-BASED NONCANCER H.I. = 2.00E-01 mg/kg	RISK-BASED CANCER ELCR= 1.00E-06 mg/kg	CANCER RISK-BASED CONC. 1.00E-06 mg/kg	LOWEST RISK-BASED CONCENTRATION mg/kg	HIGHEST RISK, MDL & BACKGROUND mg/kg	LOWEST CEILING, (RISK, MDL, BCKGRND) mg/kg	S-2 STANDARD FROM S-2 SPREADSHEET (RAW) mg/kg	HIGHEST CALCULATED S-2 OR S-3 STANDARD mg/kg
DIETHYL PHTHALATE	1.3E+06	0.0E+00	0.00	1.3E+06	1.3E+06	5.00E+03	2.50E+03	5.00E+03
DIMETHYL PHTHALATE	6.9E+04	0.0E+00	0.00	6.9E+04	6.9E+04	5.00E+03	2.50E+03	5.00E+03
DIMETHYLPHENOL, 2,4-	4.4E+03	0.0E+00	0.00	4.4E+03	4.4E+03	4.41E+03	9.43E+02	4.41E+03
DINITROPHENOL, 2,4-	4.4E+01	0.0E+00	0.00	4.4E+01	4.4E+01	4.41E+01	9.43E+01	9.43E+01
DINITROTOLUENE, 2,4-	8.2E+01	6.6E+00	6.57	6.6E+00	6.6E+00	6.57E+00	1.79E+00	6.57E+00
ENDOSULFAN	1.7E+02	0.0E+00	0.00	1.7E+02	1.7E+02	1.68E+02	3.60E+02	3.60E+02
ENDRIN	6.9E+00	0.0E+00	0.00	6.9E+00	6.9E+00	6.85E+00	1.47E+01	1.47E+01
ETHYLBENZENE	2.8E+04	0.0E+00	0.00	2.8E+04	2.8E+04	2.50E+03	1.00E+03	2.50E+03
ETHYLENE DIBROMIDE	1.0E+01	6.6E-02	0.07	6.6E-02	6.6E-02	6.57E-02	2.00E-02	6.57E-02
FLUORANTHENE	1.1E+04	0.0E+00	0.00	1.1E+04	1.1E+04	5.00E+03	2.40E+03	5.00E+03
FLUORENE	1.1E+04	0.0E+00	0.00	1.1E+04	1.1E+04	5.00E+03	2.40E+03	5.00E+03
HEPTACHLOR	1.4E+01	6.8E-01	0.68	6.8E-01	6.8E-01	6.75E-01	1.84E-01	6.75E-01
HEPTACHLOR EPOXIDE	3.6E-01	3.3E-01	0.33	3.3E-01	3.3E-01	3.34E-01	9.00E-02	3.34E-01
HEXACHLOROBENZENE	3.3E+01	2.8E+00	2.79	2.8E+00	2.8E+00	2.79E+00	7.60E-01	2.79E+00
HEXACHLOROBUTADIENE	5.6E+01	3.9E+01	38.97	3.9E+01	3.9E+01	3.90E+01	1.06E+01	3.90E+01
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	8.4E+01	2.3E+00	2.34	2.3E+00	2.3E+00	2.34E+00	6.40E-01	2.34E+00
HEXACHLOROETHANE	6.0E+01	4.7E+01	46.72	4.7E+01	4.7E+01	4.67E+01	1.28E+01	4.67E+01
INDENO(1,2,3-cd)PYRENE	1.2E+03	4.2E-01	0.42	4.2E-01	4.2E-01	4.16E-01	3.80E-01	4.16E-01
MERCURY	2.7E+01	0.0E+00	0.00	2.7E+01	2.7E+01	2.66E+01	5.71E+01	5.71E+01
METHOXYCHLOR	1.4E+02	0.0E+00	0.00	1.4E+02	1.4E+02	1.40E+02	3.00E+02	3.00E+02
METHYL ETHYL KETONE	2.6E+04	0.0E+00	0.00	2.6E+04	2.6E+04	2.50E+03	1.00E+03	2.50E+03
METHYL ISOBUTYL KETONE	2.6E+04	0.0E+00	0.00	2.6E+04	2.6E+04	1.00E+03	5.00E+02	1.00E+03
METHYL MERCURY	8.4E+00	0.0E+00	0.00	8.4E+00	8.4E+00	8.42E+00	1.80E+01	1.80E+01
METHYL TERT BUTYL ETHER	2.7E+03	0.0E+00	0.00	2.7E+03	2.7E+03	5.00E+02	5.00E+02	5.00E+02
METHYLENE CHLORIDE	3.1E+03	7.4E+02	744.88	7.4E+02	7.4E+02	7.45E+02	2.03E+02	7.45E+02
METHYLNAPHTHALENE, 2-	2.1E+03	0.0E+00	0.00	2.1E+03	2.1E+03	2.06E+03	2.50E+03	2.50E+03
MOLYBDENUM	2.6E+02	0.0E+00	0.00	2.6E+02	2.6E+02	2.58E+02	5.52E+02	5.52E+02
NAPHTHALENE	2.1E+03	0.0E+00	0.00	2.1E+03	2.1E+03	2.06E+03	2.50E+03	2.50E+03
NICKEL	3.3E+02	0.0E+00	0.00	3.3E+02	3.3E+02	3.33E+02	7.13E+02	7.13E+02
PENTACHLOROPHENOL	1.4E+03	4.3E+01	42.96	4.3E+01	4.3E+01	4.30E+01	1.17E+01	4.30E+01
PHENANTHRENE	1.2E+03	0.0E+00	0.00	1.2E+03	1.2E+03	1.25E+03	2.50E+03	2.50E+03
PHENOL	1.3E+04	0.0E+00	0.00	1.3E+04	1.3E+04	2.50E+03	1.00E+03	2.50E+03
PYRENE	8.4E+03	0.0E+00	0.00	8.4E+03	8.4E+03	5.00E+03	1.80E+03	5.00E+03
SELENIUM	1.4E+03	0.0E+00	0.00	1.4E+03	1.4E+03	1.44E+03	2.50E+03	2.50E+03
SILVER	1.1E+02	0.0E+00	0.00	1.1E+02	1.1E+02	1.14E+02	2.44E+02	2.44E+02
STYRENE	5.6E+04	1.0E+02	101.32	1.0E+02	1.0E+02	1.01E+02	2.76E+01	1.01E+02
TETRACHLOROETHANE, 1,1,1,2-	1.3E+02	1.8E+01	18.07	1.8E+01	1.8E+01	1.81E+01	4.94E+00	1.81E+01
TETRACHLOROETHANE, 1,1,2,2-	0.0E+00	2.3E+00	2.35	2.3E+00	2.3E+00	2.35E+00	6.43E-01	2.35E+00
TETRACHLOROETHYLENE	5.2E+03	1.1E+03	1074.34	1.1E+03	1.1E+03	1.07E+03	2.92E+02	1.07E+03
THALLIUM	1.5E+02	0.0E+00	0.00	1.5E+02	1.5E+02	1.47E+02	3.17E+01	1.47E+02
TOLUENE	8.8E+04	0.0E+00	0.00	8.8E+04	8.8E+04	2.50E+03	1.00E+03	2.50E+03
TRICHLOROBENZENE, 1,2,4-	6.2E+02	0.0E+00	0.00	6.2E+02	6.2E+02	6.19E+02	1.33E+03	1.33E+03
TRICHLOROETHANE, 1,1,1-	4.6E+04	0.0E+00	0.00	4.6E+04	4.6E+04	5.00E+02	5.00E+02	5.00E+02
TRICHLOROETHANE, 1,1,2-	2.4E+02	1.1E+01	11.47	1.1E+01	1.1E+01	1.15E+01	3.14E+00	1.15E+01
TRICHLOROETHYLENE	1.0E+03	5.1E+02	507.87	5.1E+02	5.1E+02	5.00E+02	1.38E+02	5.00E+02
TRICHLOROPHENOL, 2,4,5-	2.2E+04	0.0E+00	0.00	2.2E+04	2.2E+04	5.00E+03	2.50E+03	5.00E+03
TRICHLOROPHENOL 2,4,6-	0.0E+00	2.2E+02	216.97	2.2E+02	2.2E+02	2.17E+02	5.92E+01	2.17E+02
VANADIUM	4.3E+02	0.0E+00	0.00	4.3E+02	4.3E+02	4.27E+02	9.12E+02	9.12E+02
VINYL CHLORIDE	5.2E+01	1.9E+00	1.85	1.9E+00	1.9E+00	1.85E+00	5.04E-01	1.85E+00
XYLENES (Mixed Isomers)	1.8E+05	0.0E+00	0.00	1.8E+05	1.8E+05	2.50E+03	1.00E+03	2.50E+03
ZINC	4.7E+04	0.0E+00	0.00	4.7E+04	4.7E+04	5.00E+03	2.50E+03	5.00E+03

SOIL CATEGORY S-3	S-3	BASIS
DIRECT CONTACT LEVELS	DIRECT CONTACT	
	STANDARD	
	mg/kg	
CHEMICAL PARAMETER		
ACENAPHTHENE	5000.00	Ceiling
ACENAPHTHYLENE	2500.00	from S-2
ACETONE	2500.00	Ceiling
ALDRIN	0.15	Cancer Risk
ANTHRACENE	5000.00	Ceiling
ANTIMONY	44.20	from S-2
BARIUM	4070.00	Noncancer Risk
BENZENE	231.43	Cancer Risk
BENZO(a)ANTHRACENE	0.74	Background
BENZO(a)PYRENE	0.49	Background
BENZO(b)FLUORANTHENE	0.47	Background
BENZO(g,h,i)PERYLENE	1250.00	from S-2
BENZO(k)FLUORANTHENE	0.48	Background
BERYLLIUM	3.14	Cancer Risk
BIPHENYL, 1,1-	3095.98	Noncancer Risk
BIS(2-CHLOROETHYL)ETHER	0.66	PQL
BIS(2-CHLOROISOPROPYL)ETHER	9.34	Cancer Risk
BIS(2-ETHYLHEXYL)PHTHALATE	1210.65	Cancer Risk
BROMODICHLOROMETHANE	80.11	Cancer Risk
BROMOFORM	707.16	Cancer Risk
BROMOMETHANE	721.65	Noncancer Risk
CADMIUM	41.40	from S-2
CARBON TETRACHLORIDE	42.97	Cancer Risk
CHLORDANE	5.32	Noncancer Risk
CHLOROANILINE, p-	441.99	from S-2
CHLOROBENZENE	2500.00	Ceiling
CHLOROFORM	515 46	Noncancer Risk
CHLOROPHENOL, 2-	1101.32	Noncancer Risk
CHROMIUM(III)	5000.00	Ceiling
CHROMIUM(VI)	1125.18	Noncancer Risk
CHRYSENE	0.69	Background
COBALT	3370 00	Noncancer Risk
COPPER	2500 00	from S-2
CYANIDE	385.36	Noncancer Risk
DIBENZO(a,h)ANTHRACENE	0 84	Cancer Risk
DIBROMOCHLOROMETHANE	66 51	Cancer Risk
DICHLOROBENZENE, 1,2- (o-DCB)	500 00	from S-2
DICHLOROBENZENE, 1,3- (m-DCB)	500 00	from S-2(o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)	232 77	Cancer Risk
DICHLOROBENZIDINE, 3,3'-	2 65	Cancer Risk
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	12 66	Cancer Risk
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	8 94	Cancer Risk
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	8 94	Cancer Risk
DICHLOROETHANE, 1,1-	500 00	from S-2
DICHLOROETHANE, 1,2-	61 39	Cancer Risk
DICHLOROETHYLENE, 1,1-	9.13	Cancer Risk
DICHLOROETHYLENE, CIS-1,2-	500 00	from S-2
DICHLOROETHYLENE, TRANS-1,2-	2500 00	Ceiling
DICHLOROPHENOL, 2,4-	94.19	from S-2
DICHLOROPROPANE, 1,2-	44.70	Cancer Risk
DICHLOROPROPENE, 1,3-	16.89	Cancer Risk
DIELDRIN	0.15	Cancer Risk

SOIL CATEGORY S-3	S-3	BASIS
DIRECT CONTACT LEVELS	DIRECT CONTACT STANDARD mg/kg	
CHEMICAL PARAMETER		
DIETHYL PHTHALATE	5000.00	Ceiling
DIMETHYL PHTHALATE	5000.00	Ceiling
DIMETHYLPHENOL, 2,4-	4405.29	Noncancer Risk
DINITROPHENOL, 2,4-	94.30	from S-2
DINITROTOLUENE, 2,4-	6.57	Cancer Risk
ENDOSULFAN	360.00	from S-2
ENDRIN	14.67	from S-2
ETHYLBENZENE	2500.00	Ceiling
ETHYLENE DIBROMIDE	0.66	Cancer Risk
FLUORANTHENE	5000.00	Ceiling
FLUORENE	5000.00	Ceiling
HEPTACHLOR	0.68	Cancer Risk
HEPTACHLOR EPOXIDE	0.33	Cancer Risk
HEXACHLOROBENZENE	2.79	Cancer Risk
HEXACHLOROBUTADIENE	38.97	Cancer Risk
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	2.34	Cancer Risk
HEXACHLOROETHANE	46.72	Cancer Risk
INDENO(1,2,3-cd)PYRENE	0.42	Cancer Risk
MERCURY	57.14	from S-2
METHOXYCHLOR	300.30	from S-2
METHYL ETHYL KETONE	2500.00	Ceiling
METHYL ISOBUTYL KETONE	1000.00	Ceiling
METHYL MERCURY	18.02	from S-2
METHYL TERT BUTYL ETHER	500.00	from S-2
METHYLENE CHLORIDE	744.88	Cancer Risk
METHYLNAPHTHALENE, 2-	2500.00	from S-2
MOLYBDENUM	552.00	from S-2
NAPHTHALENE	2500.00	from S-2
NICKEL	713.01	from S-2
PENTACHLOROPHENOL	42.98	Cancer Risk
PHENANTHRENE	2500.00	from S-2
PHENOL	2500.00	Ceiling
PYRENE	5000.00	Ceiling
SELENIUM	2500.00	from S-2
SILVER	244.50	from S-2
STYRENE	101.32	Cancer Risk
TETRACHLOROETHANE, 1,1,1,2-	18.07	Cancer Risk
TETRACHLOROETHANE, 1,1,2,2-	2.35	Cancer Risk
TETRACHLOROETHYLENE	1074.34	Cancer Risk
THALLIUM	146.60	Noncancer Risk
TOLUENE	2500.00	Ceiling
TRICHLOROBENZENE, 1,2,4-	1300.00	Ceiling
TRICHLOROETHANE, 1,1,1-	500.00	Ceiling
TRICHLOROETHANE, 1,1,2-	12.00	Cancer Risk
TRICHLOROETHYLENE	500.00	Ceiling
TRICHLOROPHENOL, 2,4,5-	5000.00	Ceiling
TRICHLOROPHENOL 2,4,6-	218.97	Cancer Risk
VANADIUM	912.00	from S-2
VINYL CHLORIDE	1.90	Cancer Risk
XYLENES (Mixed Isomers)	2500.00	from S-2
ZINC	5000.00	Ceiling

Appendix B.1.4: Derivation of Leaching-Based Soil Concentrations (Coarse Textured Soils).

LEACHING BASED SOIL CONCENTRATIONS					Groundwater Standards			Base-Level Soil			Leaching-Based Soil Conc Equations		
COARSE TEXTURED SOILS													
	SOLUBILITY IN WATER	SOIL MDL/PQL	HENRY'S LAW CONSTANT	Koc	GW-1 STANDARD	GW-2 STANDARD	GW-3 STANDARD	SOIL S-1 STANDARD	SOIL S-2 STANDARD	SOIL S-3 STANDARD	S-/GW1	S-/GW2	S-/GW3
CHEMICAL PARAMETER	µg/liter	ug/kg	atm-m3/mol	ml/g	ug/L	ug/L	ug/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ACENAPHTHENE	3.42E+03	50.00	2.41E-04	4.6E+03	20.00		1710.00	1000.00	2500.00	5000.00	1.53E+01	0.00E+00	1.31E+03
ACENAPHTHYLENE	3.93E+03	50.00	1.45E-03	2.5E+03	307.69		1970.00	100.00	2500.00	2500.00	1.30E+02	0.00E+00	8.35E+02
ACETONE	1.00E+09	100.00	4.26E-05	5.4E+00	3000.00	50000.00	3300.00	500.00	1000.00	2500.00	3.47E+00	5.78E+01	3.81E+00
ALDRIN	1.70E+01	50.00	4.96E-04	4.9E+04	0.01	0.20	8.50	0.05	0.05	0.15	8.13E-02	1.63E+00	6.91E+01
ANTHRACENE	1.29E+03	50.00	8.60E-05	1.4E+04	645.00		12.00	1000.00	2500.00	5000.00	1.50E+03	0.00E+00	2.79E+01
ANTIMONY	-	1000.00	-	-	6.00		16000.00	13.45	44.20	44.20	0.00E+00	0.00E+00	0.00E+00
BARIUM	-	2500.00	-	-	1000.00		23000.00	1000.00	2500.00	4070.00	0.00E+00	0.00E+00	0.00E+00
BENZENE	1.78E+06	2.00	5.50E-03	8.3E+01	5.00	1866.02	50000.00	34.69	62.88	231.43	2.40E-01	8.94E+01	2.40E+03
BENZO(a)ANTHRACENE	1.00E+01	50.00	1.00E-06	2.0E+05	0.20		5.00	120.00	120.00	120.00	6.64E+00	0.00E+00	1.66E+02
BENZO(a)PYRENE	3.80E+00	50.00	4.90E-07	5.5E+06	0.01	1.90	1.90	1.20	1.20	1.20	9.13E+00	1.73E+03	1.73E+03
BENZO(b)FLUORANTHENE	1.40E+01	50.00	1.22E-05	5.5E+05	0.20		7.00	12.00	12.00	12.00	1.83E+01	0.00E+00	6.39E+02
BENZO(g,h,i)PERYLENE	2.60E-01	100.00	1.44E-07	1.6E+06	0.20		0.20	120.00	120.00	120.00	5.31E+01	0.00E+00	5.31E+01
BENZO(k)FLUORANTHENE	8.00E-01	50.00	3.87E-05	5.5E+05	0.20		0.40	12.00	12.00	12.00	1.83E+01	0.00E+00	3.65E+01
BERYLLIUM	-	500.00	-	-	4.00		53.00	1.20	1.20	3.14	0.00E+00	0.00E+00	0.00E+00
BIPHENYL, 1,1-	7.50E+03	50.00	4.08E-04		350.00		1700.00	1000.00	2500.00	3085.98	8.86E-01	0.00E+00	4.31E+00
BIS(2-CHLOROETHYL)ETHER	1.02E+07	660.00	1.30E-05	1.3E+01	4.40	113.92	50000.00	0.66	0.66	0.66	9.55E-03	2.47E-01	1.09E+02
BIS(2-CHLOROISOPROPYL)ETHER	1.70E+06	660.00	1.13E-04	6.1E+01	2.20	432.50	50000.00	1.85	2.56	9.34	2.38E-02	4.68E+00	5.41E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.30E+03	660.00	3.00E-07	1.3E+05	6.00	650.00	30.00	128.47	325.27	1210.65	9.96E+01	1.08E+04	4.98E+02
BROMODICHLOROMETHANE	4.50E+06	5.00	2.12E-03	6.3E+01	5.00		50000.00	14.15	24.51	90.11	1.18E-01	0.00E+00	1.18E+03
BROMOFORM	3.20E+06	2.00	5.32E-04	1.1E+02	5.00	835.13	50000.00	111.04	192.37	707.16	1.12E-01	1.87E+01	1.12E+03
BROMOMETHANE	1.75E+07	3.00	1.97E-01	5.9E+00	10.00	3.70	3200.00	47.06	154.70	721.65	1.22E+01	4.53E+00	3.92E+03
CADMIUM	-	1000.00	-	-	5.00		11.00	14.10	41.40	41.40	0.00E+00	0.00E+00	0.00E+00
CARBON TETRACHLORIDE	8.00E+05	2.00	2.93E-02	1.1E+02	5.00	16.68	50000.00	6.75	11.69	42.97	1.00E+00	3.34E+00	1.00E+04
CHLORDANE	5.60E+01	50.00	4.79E-05	4.4E+04	7.00	27.58	0.04	0.99	2.00	5.32	5.07E+01	2.00E+02	2.90E-01
CHLOROANILINE, p-	2.60E+06	1300.00	3.31E-07	6.4E+01	28.00		100.00	100.00	441.99	441.99	2.98E-01	0.00E+00	1.06E+00
CHLOROBENZENE	4.88E+05	2.00	3.93E-03	3.3E+02	30.00	1243.56	500.00	500.00	1000.00	2500.00	2.38E+00	9.87E+01	3.97E+01
CHLOROFORM	9.30E+06	2.00	3.39E-03	3.1E+01	5.00	432.50	12400.00	143.80	249.14	515.46	1.31E-01	1.13E+01	3.25E+02
CHLOROPHENOL, 2-	2.85E+07	100.00	1.03E-05	1.1E+02	0.30		43800.00	95.15	235.74	1101.32	5.50E-03	0.00E+00	8.03E+02
CHROMIUM (III)	-	1400.00	-	-	50.00		2000.00	1000.00	2500.00	5000.00	0.00E+00	0.00E+00	0.00E+00
CHROMIUM (VI)	-	2500.00	-	-	50.00		110.00	176.52	603.14	1125.18	0.00E+00	0.00E+00	0.00E+00
CHRYSENE	6.00E+00	50.00	1.05E-06	2.0E+05	0.50		3.00	12.00	12.00	12.00	1.66E+01	0.00E+00	9.96E+01
COBALT	-	2500.00	-	-			100.00	1000.00	2500.00	3370.00	0.00E+00	0.00E+00	0.00E+00
COPPER	-	5000.00	-	-	1000.00		23.00	1000.00	2500.00	2500.00	0.00E+00	0.00E+00	0.00E+00
CYANIDE	1.00E+09	50.00	1.90E+03	9.2E+00	200.00		52.00	100.00	100.00	385.36	2.36E+06	0.00E+00	6.13E+05
DIBENZO(a,h)ANTHRACENE	5.00E-01	100.00	7.30E-08	3.3E+06	0.20		0.25	1.20	1.20	1.20	1.10E+02	0.00E+00	1.37E+02
DIBROMOCHLOROMETHANE	4.00E+06	3.00	7.83E-04	8.3E+01	5.00		50000.00	10.44	18.09	66.51	9.33E-02	0.00E+00	9.33E+02
DICHLOROBENZENE, 1,2- (o-DCB)	1.45E+05	2.00	1.94E-03	1.7E+03	3.00	10076.70	7630.00	100.00	500.00	500.00	8.83E-01	2.96E+03	2.25E+03
DICHLOROBENZENE, 1,3- (m-DCB)	1.23E+05	2.00	2.63E-03	1.7E+03	630.00		7630.00	100.00	500.00	500.00	1.88E+02	0.00E+00	2.28E+03
DICHLOROBENZENE, 1,4- (p DCB)	7.90E+04	2.00	2.72E-03	1.8E+03	1.00	28748.24	7630.00	36.55	63.32	232.77	3.19E-01	9.17E+03	2.43E+03
DICHLOROBENZIDINE, 3,3'-	3.10E+03	1300.00	8.33E-07	1.6E+03	82.50		1550.00	1.30	1.30	2.65	2.13E+01	0.00E+00	4.00E+02
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	1.60E+02	50.00	7.96E-06	7.8E+05	30.00		6.00	2.23	3.45	12.66	3.87E+03	0.00E+00	7.73E+02
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	4.00E+01	10.00	6.80E-05	4.4E+06	30.00		20.00	1.57	2.44	8.94	2.17E+04	0.00E+00	1.45E+04
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	3.10E+00	50.00	3.89E-05	2.4E+05	30.00	1.55	0.05	1.57	2.44	8.94	1.19E+03	6.17E+01	1.99E+00
DICHLOROETHANE, 1,1-	5.50E+06	2.00	5.45E-03	5.8E+01	70.00	8967.34	50000.00	100.00	500.00	500.00	3.04E+00	3.89E+02	2.17E+03
DICHLOROETHANE, 1,2-	8.69E+06	2.00	1.10E-03	1.4E+01	5.00	17.09	50000.00	9.64	16.70	61.39	4.56E-02	1.56E-01	4.56E+02
DICHLOROETHYLENE, 1,1-	2.10E+05	2.00	1.49E-02	6.5E+01	7.00	0.66	50000.00	1.43	2.48	9.13	7.22E-01	6.81E-02	5.16E+03
DICHLOROETHYLENE, CIS-1,2-	8.00E+05	5.00	4.08E-03	4.9E+01	70.00		50000.00	100.00	500.00	500.00	2.34E+00	0.00E+00	1.67E+03
DICHLOROETHYLENE, TRANS-1,2-	6.00E+05	3.00	5.32E-03	4.9E+01	100.00		50000.00	500.00	1000.00	2500.00	4.12E+00	0.00E+00	2.06E+03
DICHLOROPHENOL, 2,4-	4.50E+06	100.00	2.80E-06	6.0E+03	0.30		3650.00	41.38	94.19	94.19	3.00E-01	0.00E+00	3.65E+03
DICHLOROPROPANE, 1,2-	2.70E+06	2.00	2.82E-03	4.7E+01	5.00	9.27	50000.00	7.86	12.19	44.70	1.26E-01	2.34E-01	1.26E+03
DICHLOROPROPENE, 1,3-	2.70E+06	3.00	3.50E-03	2.6E+01	1.40	3.77	2440.00	2.97	4.61	16.89	3.64E-02	9.81E-02	6.34E+01
DIELDRIN	1.86E+02	50.00	5.84E-05	7.4E+03	0.02	1.82	0.02	0.05	0.05	0.15	2.46E-02	2.24E+00	2.46E-02

LEACHING BASED SOIL CONCENTRATIONS					Groundwater Standards			Base-Level Soil			Leaching-Based Soil Conc Equations		
COARSE TEXTURED SOILS													
	SOLUBILITY IN WATER	SOIL MDL/PQL	HENRY'S LAW CONSTANT	Koc	GW-1 STANDARD	GW-2 STANDARD	GW-3 STANDARD	SOIL S-1 STANDARD	SOIL S-2 STANDARD	SOIL S-3 STANDARD	S- /GW1	S- /GW2	S- /GW3
CHEMICAL PARAMETER	µg/liter	ug/kg	atm-m3/mol	ml/g	ug/L	ug/L	ug/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
DIETHYL PHTHALATE	8.96E+05	660.00	1.14E-06	1.4E+02	5600.00		30.00	1000.00	2500.00	5000.00	1.32E+02	0.00E+00	7.07E-01
DIMETHYL PHTHALATE	5.00E+06	660.00	1.05E-07	1.4E+02	50000.00		30.00	1000.00	2500.00	5000.00	1.16E+03	0.00E+00	6.97E-01
DIMETHYLPHENOL, 2,4-	7.87E+06	200.00	1.70E-05	4.0E+01	140.00		21200.00	380.59	942.95	4405.29	9.44E-01	0.00E+00	1.43E+02
DINITROPHENOL, 2,4-	5.60E+06	200.00	6.45E-10	1.7E+01	42.00		1500.00	38.08	94.30	94.30	1.16E-01	0.00E+00	4.13E+00
DINITROTOLUENE, 2,4-	2.70E+05	660.00	4.50E-06	4.5E+01	0.50		2300.00	1.08	1.79	6.57	3.72E-03	0.00E+00	1.71E+01
ENDOSULFAN	1.50E+02	40.00	1.00E-05	3.2E+03	0.35		0.56	136.00	360.00	360.00	1.84E-01	0.00E+00	2.94E-01
ENDRIN	2.60E+02	50.00	4.00E-07	1.7E+03	2.00		0.05	5.87	14.67	14.67	5.64E-01	0.00E+00	1.41E-02
ETHYLBENZENE	1.61E+05	2.00	3.43E-03	5.8E+02	2.40	28496.79	50000.00	500.00	1000.00	2500.00	2.80E-01	3.33E+03	5.84E+03
ETHYLENE DIBROMIDE	4.30E+06	4.00	6.73E-04	4.4E+01	1.00	3.30	28000.00	0.01	0.02	0.07	1.15E-02	3.79E-02	3.21E+02
FLUORANTHENE	2.65E+02	50.00	6.50E-06	3.8E+04	132.50		132.50	909.09	2402.40	5000.00	8.36E+02	0.00E+00	8.36E+02
FLUORENE	1.90E+03	50.00	1.17E-04	7.3E+03	280.00		290.00	909.09	2402.40	5000.00	3.40E+02	0.00E+00	3.52E+02
HEPTACHLOR	5.60E+01	50.00	1.48E-03	2.2E+04	3.00	0.25	0.04	0.12	0.18	0.68	1.09E+01	9.10E-01	1.46E-01
HEPTACHLOR EPOXIDE	3.50E+02	50.00	3.16E-05	2.3E+04	3.00	5.95	175.00	0.06	0.09	0.33	1.17E+01	2.31E+01	6.81E+02
HEXACHLOROBENZENE	1.10E+02	10.00	1.70E-03	1.2E+06	1.00	0.62	36.80	0.46	0.76	2.79	2.00E+02	1.25E+02	7.34E+03
HEXACHLOROBUTADIENE	2.00E+03	10.00	2.56E-02	2.9E+04	0.45	0.87	93.00	6.86	10.63	38.97	2.23E+00	4.32E+00	4.62E+02
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	7.00E+03	10.00	4.93E-07	3.7E+03	4.00		0.80	0.41	0.64	2.34	2.47E+00	0.00E+00	4.93E-01
HEXACHLOROETHANE	5.00E+04	10.00	9.85E-03	2.0E+04	2.50	12.40	5400.00	6.33	12.78	46.72	8.45E+00	4.19E+01	1.83E+04
INDENO(1,2,3-cd)PYRENE	5.30E-01	100.00	6.95E-08	1.6E+06	0.20		0.27	12.00	12.00	12.00	5.31E+01	0.00E+00	7.04E+01
MERCURY	5.60E+01	50.00	-	-	1.00		0.12	13.26	57.14	57.14	0.00E+00	0.00E+00	0.00E+00
METHOXYCHLOR	4.00E+01	50.00	1.60E-05	7.9E+04	900.00		0.30	113.64	300.30	300.30	1.19E+04	0.00E+00	3.96E+00
METHYL ETHYL KETONE	2.75E+08	100.00	2.74E-05	3.5E+00	350.00	50000.00	50000.00	500.00	1000.00	2500.00	2.66E-01	3.80E+01	3.80E+01
METHYL ISOBUTYL KETONE	1.91E+07	50.00	1.38E-04	3.1E+00	350.00	50000.00	50000.00	100.00	500.00	1000.00	4.79E-01	6.85E+01	6.85E+01
METHYL MERCURY	-	0.00	-	-	2.10		0.12	6.82	18.02	18.02	0.00E+00	0.00E+00	0.00E+00
METHYL TERT BUTYL ETHER	4.80E+07	50.00	5.91E-04	2.7E+01	700.00	50000.00	50000.00	100.00	500.00	500.00	5.71E+00	4.08E+02	4.08E+02
METHYLENE CHLORIDE	1.67E+07	3.00	3.19E-03	8.8E+00	50.00	50000.00	50000.00	116.96	202.63	744.88	1.06E+00	1.06E+03	1.06E+03
METHYLNAPHTHALENE, 2-	2.60E+04	50.00	2.90E-04	7.2E+02	10.00	13000.00	13000.00	1000.00	2500.00	2500.00	1.21E+00	1.58E+03	1.58E+03
MOLYBDENUM	-	2500.00	-	-			7300.00	166.00	552.00	552.00	0.00E+00	0.00E+00	0.00E+00
NAPHTHALENE	3.10E+04	50.00	1.18E-03	1.3E+03	21.00	5881.21	6200.00	100.00	2500.00	2500.00	4.64E+00	1.30E+03	1.37E+03
NICKEL	-	2500.00	-	-	100.00		1600.00	305.93	713.01	713.01	0.00E+00	0.00E+00	0.00E+00
PENTACHLOROPHENOL	1.40E+04	100.00	2.80E-06	3.2E+04	30.00	2443.60	130.00	6.67	11.69	42.96	1.57E+02	1.28E+04	6.82E+02
PHENANTHRENE	8.16E+02	50.00	3.93E-05	1.4E+04	307.69		63.00	1000.00	2500.00	2500.00	7.15E+02	0.00E+00	1.46E+02
PHENOL	8.00E+07	100.00	1.30E-06	9.1E+01	4200.00	50000.00	25600.00	500.00	1000.00	2500.00	6.36E+01	7.57E+02	3.88E+02
PYRENE	1.60E+02	50.00	5.10E-06	3.8E+04	80.00		40.00	681.82	1801.80	5000.00	5.05E+02	0.00E+00	2.52E+02
SELENIUM	-	1000.00	-	-	10.00		50.00	316.76	2500.00	2500.00	0.00E+00	0.00E+00	0.00E+00
SILVER	-	250.00	-	-	35.00		1.20	97.80	244.50	244.50	0.00E+00	0.00E+00	0.00E+00
STYRENE	3.00E+05	2.00	2.61E-03	3.1E+00	100.00	936.25	50000.00	17.83	27.64	101.32	1.67E+00	1.56E+01	8.36E+02
TETRACHLOROETHANE, 1,1,1,2-	2.00E+05	5.00	1.10E-02	5.4E+01	5.00	6.00	50000.00	3.62	4.94	18.07	3.86E-01	4.64E-01	3.86E+03
TETRACHLOROETHANE, 1,1,2,2-	2.90E+06	4.00	3.80E-04	4.6E+01	1.00	22.17	24000.00	0.47	0.64	2.35	9.95E-03	2.21E-01	2.39E+02
TETRACHLOROETHYLENE	2.00E+05	2.00	2.04E-03	4.7E+02	5.00	2635.25	8400.00	168.69	292.26	1074.34	4.52E-01	2.38E+02	7.59E+02
THALLIUM	-	2500.00	-	-	2.00		400.00	4.14	31.67	146.60	0.00E+00	0.00E+00	0.00E+00
TOLUENE	5.35E+05	2.00	6.68E-03	2.7E+02	24.00	5852.93	50000.00	500.00	1000.00	2500.00	2.07E+00	6.05E+02	4.31E+03
TRICHLOROBENZENE, 1,2,4-	1.90E+04	660.00	1.42E-03	9.2E+03	70.00	619.50	500.00	371.75	1328.02	1328.00	1.08E+02	9.52E+02	7.68E+02
TRICHLOROETHANE, 1,1,1-	7.30E+05	2.00	2.31E-02	1.6E+02	200.00	4231.34	50000.00	100.00	500.00	500.00	3.39E+01	7.17E+02	8.47E+03
TRICHLOROETHANE, 1,1,2-	4.50E+06	2.00	9.10E-04	3.1E+02	5.00	16111.65	50000.00	2.28	3.14	12.00	2.85E-01	9.18E+02	2.85E+03
TRICHLOROETHYLENE	1.10E+06	4.00	9.12E-03	1.2E+02	50.00	267.94	50000.00	67.23	138.16	500.00	3.86E+00	2.07E+01	3.86E+03
TRICHLOROPHENOL, 2,4,5-	1.19E+06	100.00	2.18E-04	8.9E+01	200.00		630.00	1000.00	2500.00	5000.00	3.23E+00	0.00E+00	1.02E+01
TRICHLOROPHENOL 2,4,6-	8.00E+05	100.00	4.00E-06	2.0E+03	2.00	36654.00	9700.00	39.39	59.23	216.97	6.64E-01	1.22E+04	3.22E+03
VANADIUM	-	5000.00	-	-	-		200.00	466.00	912.00	912.00	0.00E+00	0.00E+00	0.00E+00
VINYL CHLORIDE	1.10E+03	3.00	2.78E-02	9.8E+01	2.00	0.50	550.00	0.29	0.50	1.90	3.78E-01	9.44E-02	1.04E+02
XYLENES	1.71E+05	2.00	5.27E-03	3.0E+02	300.00	5564.17	50000.00	500.00	1000.00	2500.00	2.49E+01	4.61E+02	4.14E+03
ZINC	-	25000.00	-	-	5000.00		1100.00	1000.00	2500.00	5000.00	0.00E+00	0.00E+00	0.00E+00

Appendix B.1.5: Derivation of Leaching-Based Soil Concentrations (Medium/Fine Textured Soils).

LEACHING BASED SOIL CONCENTRATIONS					Groundwater Standards			Base-Level Soil			Leaching-Based Soil Conc Equations		
MEDIUM/FINE TEXTURED SOIL													
	SOLUBILITY IN WATER	SOIL MDL/PQL	HENRY'S LAW CONSTANT	Koc	GW-1 STANDARD	GW-2 STANDARD	GW-3 STANDARD	SOIL S-1 STANDARD	SOIL S-2 STANDARD	SOIL S-3 STANDARD	S-/GW1	S-/GW2	S-/GW3
CHEMICAL PARAMETER	µg/liter	ug/kg	atm-m3/mol	ml/g	ug/L	ug/L	ug/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ACENAPHTHENE	3.42E+03	50.00	2.41E-04	4.6E+03	20.00		1710.00	1000.00	2500.00	5000.00	1.53E+01	0.00E+00	1.31E+03
ACENAPHTHYLENE	3.93E+03	50.00	1.45E-03	2.5E+03	307.69		1970.00	100.00	2500.00	2500.00	1.30E+02	0.00E+00	8.35E+02
ACETONE	1.00E+09	100.00	4.26E-05	5.4E+00	3000.00	50000.00	3300.00	500.00	1000.00	2500.00	3.47E+00	5.78E+01	3.81E+00
ALDRIN	1.70E+01	50.00	4.96E-04	4.9E+04	0.01	1.30	8.50	0.05	0.05	0.15	8.13E-02	1.06E+01	6.91E+01
ANTHRACENE	1.29E+03	50.00	8.60E-05	1.4E+04	645.00		12.00	1000.00	2500.00	5000.00	1.50E+03	0.00E+00	2.79E+01
ANTIMONY	-	1000.00	-	-	6.00		16000.00	13.45	44.20	44.20	0.00E+00	0.00E+00	0.00E+00
BARIUM	-	2500.00	-	-	1000.00		23000.00	1000.00	2500.00	4070.00	0.00E+00	0.00E+00	0.00E+00
BENZENE	1.78E+06	2.00	5.50E-03	8.3E+01	5.00	12000.00	50000.00	34.69	62.88	231.43	2.40E-01	5.75E+02	2.40E+03
BENZO(a)ANTHRACENE	1.00E+01	50.00	1.00E-06	2.0E+05	0.20		5.00	120.00	120.00	120.00	6.64E+00	0.00E+00	1.66E+02
BENZO(a)PYRENE	3.80E+00	50.00	4.90E-07	5.5E+06	0.01	1.90	1.90	1.20	1.20	1.20	9.13E+00	1.73E+03	1.73E+03
BENZO(b)FLUORANTHENE	1.40E+01	50.00	1.22E-05	5.5E+05	0.20		7.00	12.00	12.00	12.00	1.83E+01	0.00E+00	6.39E+02
BENZO(g,h,i)PERYLENE	2.60E-01	100.00	1.44E-07	1.6E+06	0.20		0.20	120.00	120.00	120.00	5.31E+01	0.00E+00	5.31E+01
BENZO(k)FLUORANTHENE	8.00E-01	50.00	3.87E-05	5.5E+05	0.20		0.40	12.00	12.00	12.00	1.83E+01	0.00E+00	3.65E+01
BERYLLIUM	-	500.00	-	-	4.00		53.00	1.20	1.20	3.14	0.00E+00	0.00E+00	0.00E+00
BIPHENYL, 1,1-	7.50E+03	50.00	4.08E-04		350.00		1700.00	1000.00	2500.00	3095.98	8.86E-01	0.00E+00	4.31E+00
BIS(2-CHLOROETHYL)ETHER	1.02E+07	660.00	1.30E-05	1.3E+01	4.40	710.00	50000.00	0.66	0.66	0.66	9.55E-03	1.54E+00	1.09E+02
BIS(2-CHLOROISOPROPYL)ETHER	1.70E+06	660.00	1.13E-04	6.1E+01	2.20	2700.00	50000.00	1.85	2.56	9.34	2.38E-02	2.92E+01	5.41E+02
BIS(2-ETHYLHEXYL)PHTHALATE	1.30E+03	660.00	3.00E-07	1.0E+05	6.00	650.00	30.00	128.47	325.27	1210.65	9.96E+01	1.08E+04	4.98E+02
BROMODICHLOROMETHANE	4.50E+06	5.00	2.12E-03	6.3E+01	6.00		50000.00	14.15	24.51	90.11	1.18E-01	0.00E+00	1.18E+03
BROMOFORM	3.20E+06	2.00	5.32E-04	1.1E+02	5.00	5200.00	50000.00	111.04	192.37	707.16	1.12E-01	1.16E+02	1.12E+03
BROMOMETHANE	1.75E+07	3.00	1.97E-01	5.9E+00	10.00	16.00	3200.00	47.06	154.70	721.65	1.22E+01	1.96E+01	3.92E+03
CADMIUM	-	1000.00	-	-	5.00		11.00	14.10	41.40	41.40	0.00E+00	0.00E+00	0.00E+00
CARBON TETRACHLORIDE	8.00E+05	2.00	2.93E-02	1.1E+02	5.00	100.00	50000.00	6.75	11.69	42.97	1.00E+00	2.00E+01	1.00E+04
CHLORDANE	5.60E+01	50.00	4.79E-05	4.4E+04	7.00	28.00	0.04	0.99	2.00	5.32	5.07E+01	2.03E+02	2.90E-01
CHLOROANILINE, p-	2.60E+06	1300.00	3.31E-07	6.4E+01	28.00		100.00	100.00	441.99	441.99	2.98E-01	0.00E+00	1.06E+00
CHLOROBENZENE	4.88E+05	2.00	3.93E-03	3.3E+02	30.00	7800.00	500.00	500.00	1000.00	2500.00	2.38E+00	6.19E+02	3.97E+01
CHLOROFORM	9.30E+06	2.00	3.39E-03	3.1E+01	5.00	2700.00	12400.00	143.80	249.14	515.46	1.31E-01	7.07E+01	3.25E+02
CHLOROPHENOL, 2-	2.85E+07	100.00	1.03E-05	1.1E+02	0.30		43800.00	95.15	235.74	1101.32	5.50E-03	0.00E+00	8.03E+02
CHROMIUM (III)	-	1400.00	-	-	50.00		2000.00	1000.00	2500.00	5000.00	0.00E+00	0.00E+00	0.00E+00
CHROMIUM (VI)	-	2500.00	-	-	50.00		110.00	176.52	603.14	1125.18	0.00E+00	0.00E+00	0.00E+00
CHRYSENE	6.00E+00	50.00	1.05E-06	2.0E+05	0.50		3.00	12.00	12.00	12.00	1.66E+01	0.00E+00	9.96E+01
COBALT	-	2500.00	-	-			100.00	1000.00	2500.00	3370.00	0.00E+00	0.00E+00	0.00E+00
COPPER	-	5000.00	-	-	1000.00		23.00	1000.00	2500.00	2500.00	0.00E+00	0.00E+00	0.00E+00
CYANIDE	1.00E+09	50.00	1.90E+03	9.2E+00	200.00		52.00	100.00	100.00	385.36	2.36E+06	0.00E+00	6.13E+05
DIBENZO(a,h)ANTHRACENE	6.00E-01	100.00	7.30E-08	3.3E+06	0.20		0.25	1.20	1.20	1.20	1.10E+02	0.00E+00	1.37E+02
DIBROMOCHLOROMETHANE	4.00E+06	3.00	7.83E-04	8.3E+01	5.00		50000.00	10.44	18.09	66.51	9.33E-02	0.00E+00	9.33E+02
DICHLOROBENZENE, 1,2- (o-DCB)	1.45E+05	2.00	1.94E-03	1.7E+03	3.00	50000.00	7630.00	100.00	500.00	500.00	8.83E-01	1.47E+04	2.25E+03
DICHLOROBENZENE, 1,3- (m-DCB)	1.23E+05	2.00	2.63E-03	1.7E+03	630.00	50000.00	7630.00	100.00	500.00	500.00	1.88E+02	1.49E+04	2.28E+03
DICHLOROBENZENE, 1,4- (p-DCB)	7.90E+04	2.00	2.72E-03	1.8E+03	1.00	40000.00	7630.00	36.55	63.32	232.77	3.19E-01	1.28E+04	2.43E+03
DICHLOROBENZIDINE, 3,3'-	3.10E+03	1300.00	8.33E-07	1.6E+03	82.50		1550.00	1.30	1.30	2.65	2.13E+01	0.00E+00	4.00E+02
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	1.60E+02	50.00	7.96E-06	7.8E+05	30.00		6.00	2.23	3.45	12.66	3.87E+03	0.00E+00	7.73E+02
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	4.00E+01	10.00	6.80E-05	4.4E+06	30.00		20.00	1.57	2.44	8.94	2.17E+04	0.00E+00	1.45E+04
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	3.10E+00	50.00	3.89E-05	2.4E+05	30.00	1.60	0.05	1.57	2.44	8.94	1.19E+03	6.37E+01	1.89E+00
DICHLOROETHANE, 1,1-	5.50E+06	2.00	5.45E-03	5.8E+01	70.00	50000.00	50000.00	100.00	500.00	500.00	3.04E+00	2.17E+03	2.17E+03
DICHLOROETHANE, 1,2-	8.69E+06	2.00	1.10E-03	1.4E+01	5.00	110.00	50000.00	9.64	16.70	61.39	4.56E-02	1.00E+00	4.56E+02
DICHLOROETHYLENE, 1,1-	2.10E+05	2.00	1.49E-02	6.5E+01	7.00	4.10	50000.00	1.43	2.48	9.13	7.22E-01	4.23E-01	5.16E+03
DICHLOROETHYLENE, CIS-1,2-	8.00E+05	5.00	4.08E-03	4.9E+01	70.00		50000.00	100.00	500.00	500.00	2.34E+00	0.00E+00	1.67E+03
DICHLOROETHYLENE, TRANS-1,2-	6.00E+05	3.00	5.32E-03	4.9E+01	100.00		50000.00	500.00	1000.00	2500.00	4.12E+00	0.00E+00	2.06E+03
DICHLOROPHENOL, 2,4-	4.50E+06	100.00	2.80E-06	6.0E+03	0.30		3650.00	41.38	94.19	94.19	3.00E-01	0.00E+00	3.65E+03
DICHLOROPROPANE, 1,2-	2.70E+06	2.00	2.82E-03	4.7E+01	5.00	56.00	50000.00	7.86	12.19	44.70	1.26E-01	1.47E+00	1.26E+03
DICHLOROPROPENE, 1,3-	2.70E+06	3.00	3.50E-03	2.6E+01	1.40	24.00	2440.00	2.97	4.61	16.89	3.84E-02	6.24E-01	6.34E+01
DIELDRIN	1.86E+02	50.00	5.84E-05	7.4E+03	0.02	11.00	0.02	0.05	0.05	0.15	2.46E-02	1.35E+01	2.46E-02

LEACHING BASED SOIL CONCENTRATIONS

MEDIUM/FINE TEXTURED SOIL

					Groundwater Standards			Base-Level Soil			Leaching-Based Soil Conc. Equations		
CHEMICAL PARAMETER	SOLUBILITY IN WATER µg/liter	SOIL MDL/PQL ug/kg	HENRY'S LAW CONSTANT atm-m3/mol	Koc ml/g	GW-1 STANDARD ug/L	GW-2 STANDARD ug/L	GW-3 STANDARD ug/L	SOIL S-1 STANDARD mg/kg	SOIL S-2 STANDARD mg/kg	SOIL S-3 STANDARD mg/kg	S-/GW1 mg/kg	S-/GW2 mg/kg	S-/GW3 mg/kg
DIETHYL PHTHALATE	8.96E+05	660.00	1.14E-06	1.4E+02	5600.00		30.00	1000.00	2500.00	5000.00	1.32E+02	0.00E+00	7.07E-01
DIMETHYL PHTHALATE	5.00E+06	660.00	1.05E-07	1.4E+02	50000.00		30.00	1000.00	2500.00	5000.00	1.16E+03	0.00E+00	6.97E-01
DIMETHYLPHENOL, 2,4-	7.87E+06	200.00	1.70E-05	4.0E+01	140.00		21200.00	380.59	942.95	4405.29	9.44E-01	0.00E+00	1.43E+02
DINITROPHENOL, 2,4-	5.60E+06	200.00	6.45E-10	1.7E+01	42.00		1500.00	38.06	94.30	94.30	1.16E-01	0.00E+00	4.13E+00
DINITROTOLUENE, 2,4-	2.70E+05	660.00	4.50E-06	4.5E+01	0.50		2300.00	1.08	1.79	6.57	3.72E-03	0.00E+00	1.71E+01
ENDOSULFAN	1.50E+02	40.00	1.00E-05	3.2E+03	0.35		0.56	136.00	360.00	360.00	1.84E-01	0.00E+00	2.94E-01
ENDRIN	2.60E+02	50.00	4.00E-07	1.7E+03	2.00		0.05	5.87	14.67	14.67	5.64E-01	0.00E+00	1.41E-02
ETHYLBENZENE	1.61E+05	2.00	3.43E-03	5.8E+02	2.40	50000.00	50000.00	500.00	1000.00	2500.00	2.80E-01	5.84E+03	5.84E+03
ETHYLENE DIBROMIDE	4.30E+06	4.00	6.73E-04	4.4E+01	1.00	21.00	28000.00	0.01	0.02	0.02	1.15E-02	2.41E-01	3.21E+02
FLUORANTHENE	2.65E+02	50.00	6.50E-06	3.8E+04	132.50		132.50	909.09	2402.40	5000.00	8.36E+02	0.00E+00	8.36E+02
FLUORENE	1.90E+03	50.00	1.17E-04	7.3E+03	280.00		290.00	909.09	2402.40	5000.00	3.40E+02	0.00E+00	3.52E+02
HEPTACHLOR	5.60E+01	50.00	1.48E-03	2.2E+04	3.00	1.60	0.04	0.12	0.18	0.68	1.09E+01	5.83E+00	1.46E-01
HEPTACHLOR EPOXIDE	3.50E+02	50.00	3.16E-05	2.3E+04	3.00	37.00	175.00	0.06	0.09	0.33	1.17E+01	1.44E+02	6.81E+02
HEXACHLOROBENZENE	1.10E+02	10.00	1.70E-03	1.2E+06	1.00	3.90	36.80	0.46	0.76	2.79	2.00E+02	7.78E+02	7.34E+03
HEXACHLOROBUTADIENE	2.00E+03	10.00	2.56E-02	2.9E+04	0.45	5.40	93.00	6.86	10.63	38.97	2.23E+00	2.69E+01	4.62E+02
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	7.00E+03	10.00	4.93E-07	3.7E+03	4.00		0.80	0.41	0.64	2.34	2.47E+00	0.00E+00	4.93E-01
HEXACHLOROETHANE	5.00E+04	10.00	9.85E-03	2.0E+04	2.50	78.00	5400.00	6.33	12.78	46.72	8.45E+00	2.64E+02	1.83E+04
INDENO(1,2,3-cd)PYRENE	5.30E-01	100.00	6.95E-08	1.6E+06	0.20		0.27	12.00	12.00	12.00	5.31E+01	0.00E+00	7.04E+01
MERCURY	5.60E+01	50.00	-	-	1.00		0.12	13.26	57.14	57.14	0.00E+00	0.00E+00	0.00E+00
METHOXYCHLOR	4.00E+01	50.00	1.60E-05	7.9E+04	900.00		0.30	113.64	300.30	300.30	1.19E+04	0.00E+00	3.96E+00
METHYL ETHYL KETONE	2.75E+08	100.00	2.74E-05	3.5E+00	350.00	50000.00	50000.00	500.00	1000.00	2500.00	2.66E-01	3.80E+01	3.80E+01
METHYL ISOBUTYL KETONE	1.91E+07	50.00	1.38E-04	3.1E+00	350.00	50000.00	50000.00	100.00	500.00	1000.00	4.79E-01	6.85E+01	6.85E+01
METHYL MERCURY	-	0.00	-	-	2.10		0.12	6.82	18.02	18.02	0.00E+00	0.00E+00	0.00E+00
METHYL TERT BUTYL ETHER	4.80E+07	50.00	5.91E-04	2.7E+01	700.00	50000.00	50000.00	100.00	500.00	500.00	5.71E+00	4.08E+02	4.08E+02
METHYLENE CHLORIDE	1.67E+07	3.00	3.19E-03	8.8E+00	50.00	50000.00	50000.00	116.96	202.63	744.88	1.06E+00	1.06E+03	1.06E+03
METHYLNAPHTHALENE, 2-	2.60E+04	50.00	2.90E-04	7.2E+02	10.00	13000.00	13000.00	1000.00	2500.00	2500.00	1.21E+00	1.58E+03	1.58E+03
MOLYBDENUM	-	2500.00	-	-			7300.00	166.00	552.00	552.00	0.00E+00	0.00E+00	0.00E+00
NAPHTHALENE	3.10E+04	50.00	1.18E-03	1.3E+03	21.00	16000.00	6200.00	100.00	2500.00	2500.00	4.64E+00	3.54E+03	1.37E+03
NICKEL	-	2500.00	-	-	100.00		1600.00	305.93	713.01	713.01	0.00E+00	0.00E+00	0.00E+00
PENTACHLOROPHENOL	1.40E+04	100.00	2.80E-06	3.2E+04	30.00	7000.00	130.00	6.87	11.69	42.96	1.57E+02	3.67E+04	6.82E+02
PHENANTHRENE	8.16E+02	50.00	3.93E-05	1.4E+04	307.69		63.00	1000.00	2500.00	2500.00	7.15E+02	0.00E+00	1.46E+02
PHENOL	8.00E+07	100.00	1.30E-06	9.1E+01	4200.00	50000.00	25600.00	500.00	1000.00	2500.00	6.36E+01	7.57E+02	3.88E+02
PYRENE	1.60E+02	50.00	5.10E-06	3.8E+04	80.00		40.00	681.82	1801.80	5000.00	5.05E+02	0.00E+00	2.52E+02
SELENIUM	-	1000.00	-	-	10.00		50.00	316.76	2500.00	2500.00	0.00E+00	0.00E+00	0.00E+00
SILVER	-	250.00	-	-	35.00		1.20	97.80	244.50	244.50	0.00E+00	0.00E+00	0.00E+00
STYRENE	3.00E+05	2.00	2.61E-03	3.1E+00	100.00	5900.00	50000.00	17.83	27.64	101.32	1.67E+00	9.86E+01	8.36E+02
TETRACHLOROETHANE, 1,1,1,2-	2.00E+05	5.00	1.10E-02	5.4E+01	5.00	38.00	50000.00	3.62	4.94	18.07	3.86E-01	2.94E+00	3.86E+03
TETRACHLOROETHANE, 1,1,2,2-	2.90E+06	4.00	3.80E-04	4.6E+01	1.00	140.00	24000.00	0.47	0.64	2.35	9.95E-03	1.39E+00	2.39E+02
TETRACHLOROETHYLENE	2.00E+05	2.00	2.04E-03	4.7E+02	5.00	17000.00	8400.00	168.69	292.26	1074.34	4.52E-01	1.54E+03	7.59E+02
THALLIUM	-	2500.00	-	-	2.00		400.00	4.14	31.67	146.60	0.00E+00	0.00E+00	0.00E+00
TOLUENE	5.35E+05	2.00	6.68E-03	2.7E+02	24.00	37000.00	50000.00	500.00	1000.00	2500.00	2.07E+00	3.19E+03	4.31E+03
TRICHLOROBENZENE, 1,2,4-	1.90E+04	660.00	1.42E-03	9.2E+03	70.00	3900.00	500.00	371.75	1328.02	1328.00	1.08E+02	5.99E+03	7.68E+02
TRICHLOROETHANE, 1,1,1-	7.30E+05	2.00	2.31E-02	1.6E+02	200.00	26000.00	50000.00	100.00	500.00	500.00	3.39E+01	4.41E+03	8.47E+03
TRICHLOROETHANE, 1,1,2-	4.50E+06	2.00	9.10E-04	3.1E+02	5.00	50000.00	50000.00	2.28	3.14	12.00	2.85E-01	2.85E+03	2.85E+03
TRICHLOROETHYLENE	1.10E+06	4.00	9.12E-03	1.2E+02	50.00	1700.00	50000.00	67.23	138.16	500.00	3.86E+00	1.31E+02	3.86E+03
TRICHLOROPHENOL, 2,4,5-	1.19E+06	100.00	2.18E-04	8.9E+01	200.00		630.00	1000.00	2500.00	5000.00	3.23E+00	0.00E+00	1.02E+01
TRICHLOROPHENOL 2,4,6-	8.00E+05	100.00	4.00E-06	2.0E+03	2.00	50000.00	9700.00	39.39	59.23	216.97	6.64E-01	1.66E+04	3.22E+03
VANADIUM	-	5000.00	-	-			200.00	466.00	912.00	912.00	0.00E+00	0.00E+00	0.00E+00
VINYL CHLORIDE	1.10E+03	3.00	2.78E-02	9.8E+01	2.00	1.30	550.00	0.29	0.50	1.90	3.78E-01	2.45E-01	1.04E+02
XYLENES	1.71E+05	2.00	5.27E-03	3.0E+02	300.00	35000.00	50000.00	500.00	1000.00	2500.00	2.49E+01	2.90E+03	4.14E+03
ZINC	-	25000.00	-	-	5000.00		1100.00	1000.00	2500.00	5000.00	0.00E+00	0.00E+00	0.00E+00

Appendix B.1.6: Derivation of GW-1 and GW-3 Groundwater Concentrations.

GROUNDWATER (GW1 AND GW3) CHEMICAL PARAMETER	ORAL RfD (or substitute) mg/kg/day	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	RAF_Sc WATER INGEST	RAF_Sh WATER INGEST	RAF_Sa WATER INGEST	WATER MDL/PQL µg/L	ODOR THRESHOLD µg/L	SOLUBILITY µg/L	CEILING	BASIS	LOWEST AMBIENT WATER QUALITY CRITERIA µg/L	BASIS
ACENAPHTHENE	6.0E-02		1.00E+00	1.00E+00	NC	1.3	2.00E+01	3.42E+03	5.00E+04		5.20E+02	FCC
ACENAPHTHYLENE	4.0E-02		9.10E-01	9.10E-01	NC	1.4		3.93E+03	5.00E+04			
ACETONE	1.0E-01		1.00E+00	1.00E+00	NC	0.01	2.00E+04	1.00E+09	5.00E+04	ORSGL	3.30E+02	AQUIRE LOEL
ALDRIN	3.0E-05	1.70E+01	1.00E+00	1.00E+00	1.00E+00	0.01	1.70E+01	1.70E+01	5.00E+04		3.0	FAC
ANTHRACENE	3.0E-01		1.00E+00	1.00E+00	NC	0.01		1.29E+03	5.00E+04		1.20E+00	PWQO - LOEL
ANTIMONY	4.0E-04		1.00E+00	1.00E+00	NC	0.1		-	5.00E+04	ORSGL	1.60E+03	USEPA LOEL FCC
ARSENIC	3.0E-04	1.75E+00	1.00E+00	1.00E+00	1.00E+00	0.5		-	5.00E+04	MMCL	4.80E+01	USEPA LOEL FCC
BARIUM						0.25			5.00E+04		2.30E+03	AQUIRE LOEL
BENZENE	5.0E-03	2.90E-02	1.00E+00	1.00E+00	1.00E+00	0.5	2.00E+03	1.78E+06	5.00E+04	MMCL	5.30E+03	USEPA LOEL FAC
BENZO(a)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.2		1.00E+01	5.00E+04	ORSGL*	1.80E+00	PWQO - LOEL
BENZO(a)PYRENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.05		3.80E+00	5.00E+04	ORSGL	2.10E-01	PWQO - LOEL
BENZO(b)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.1		1.40E+01	5.00E+04	ORSGL*	ND	
BENZO(g,h,i)PERYLENE	4.0E-02		9.10E-01	9.10E-01	NC	0.2		2.60E-01	5.00E+04		2.00E-01	PWQO - LOEL
BENZO(k)FLUORANTHENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.01		8.00E-01	5.00E+04	ORSGL*	7.40E+00	PWQO - LOEL
BERYLLIUM	5.0E-03	4.30E+00	1.00E+00	1.00E+00	1.00E+00	0.25		-	5.00E+04	ORSGL	5.30E+00	FCC
BIPHENYL, 1,1-	5.0E-02		1.00E+00	1.00E+00	NC	0.6		7.50E+03	5.00E+04		1.70E+02	AQUIRE LOEL
BIS(2-CHLOROETHYL)ETHER		1.10E+00	NC	NC	1.00E+00	4.4		1.02E+07	5.00E+04		2.38E+05	FAC
BIS(2-CHLOROISOPROPYL)ETHER	4.0E-02	7.00E-02	1.00E+00	1.00E+00	1.00E+00	2.2	3.20E+02	1.70E+06	5.00E+04		2.38E+05	FAC
BIS(2-ETHYLHEXYL)PHTHALATE	2.0E-02	1.40E-02	1.00E+00	1.00E+00	1.00E+00	2.2		1.30E+03	5.00E+04	ORSGL	3.00E+00	FCC
BROMODICHLOROMETHANE	2.0E-02	6.20E-02	1.00E+00	1.00E+00	1.00E+00	0.8		4.50E+06	5.00E+04	ORSGL**	6.70E+04	PWQO - LOEL
BROMOFORM	2.0E-02	7.90E-03	1.00E+00	1.00E+00	1.00E+00	5	5.10E+02	3.20E+06	5.00E+04	ORSGL**	2.90E+04	PWQO - LOEL
BROMOMETHANE	1.4E-03		1.00E+00	1.00E+00	NC	3.7		1.75E+07	5.00E+04	ORSGL	3.20E+02	PWQO - LOEL
CADMIUM	5.0E-04		1.00E+00	1.00E+00	NC	0.25		-	5.00E+04	MMCL	1.10E+00	FCC
CARBON TETRACHLORIDE	7.0E-04	1.30E-01	1.00E+00	1.00E+00	1.00E+00	2	5.20E+02	8.00E+05	5.00E+04	MMCL	3.52E+04	FAC
CHLORDANE	6.0E-05	1.30E+00	1.00E+00	1.00E+00	1.00E+00	0.02	2.50E+00	5.60E+01	5.00E+04	MMCL	4.00E-03	FCC
CHLOROANILINE, p-	4.0E-03		1.00E+00	1.00E+00	NC	20		2.60E+06	5.00E+04		1.00E+01	AQUIRE LOEL
CHLOROBENZENE	2.0E-02		1.00E+00	1.00E+00	NC	0.5	5.00E+01	4.88E+05	5.00E+04	MMCL	5.00E+01	FCC
CHLOROFORM	1.0E-02	6.10E-03	1.00E+00	1.00E+00	1.00E+00	1	2.40E+03	9.30E+06	5.00E+04	ORSGL**	1.24E+03	FCC
CHLOROPHENOL, 2-	5.0E-03		1.00E+00	1.00E+00	NC	0.3	1.80E-01	2.85E+07	5.00E+04		4.38E+03	FAC
CHROMIUM(III)	1.0E+00		1.00E+00	1.00E+00	NC	2.5		-	5.00E+04	MMCL(TOTAL)	2.00E+02	PWQO - LOEL
CHROMIUM(VI)	5.0E-03		1.00E+00	1.00E+00	NC	10		-	5.00E+04	MMCL	1.10E+01	FCC
CHRYSENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.5		6.00E+00	5.00E+04	ORSGL*	7.00E-01	PWQO - LOEL
COBALT						0.1			5.00E+04		1.00E+01	AQUIRE LOEL
COPPER						2.5			5.00E+04		2.30E+00	AQUIRE LOEL
CYANIDE	2.0E-02		1.00E+00	1.00E+00	NC	5	1.70E+02	1.00E+09	5.00E+04	ORSGL	5.20E+00	FCC - 4 DAY AVG. CONC.
DIBENZO(a,h)ANTHRACENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.1		5.00E-01	5.00E+04	ORSGL*	1.50E+01	PWQO - LOEL
DIBROMOCHLOROMETHANE	2.0E-02	8.40E-02	1.00E+00	1.00E+00	1.00E+00	2		4.00E+06	5.00E+04	ORSGL**	6.50E+04	AQUIRE LOEL
DICHLOROBENZENE, 1,2- (o-DCB)	9.0E-02		1.00E+00	1.00E+00	NC	0.5	1.00E+01	1.45E+05	5.00E+04	MMCL	7.63E+02	FCC
DICHLOROBENZENE, 1,3- (m-DCB)	9.0E-02		1.00E+00	1.00E+00	NC	0.5		1.23E+05	5.00E+04		7.63E+02	FCC
DICHLOROBENZENE, 1,4- (p-DCB)		2.40E-02	NC	NC	1.00E+00	0.5	1.10E+01	7.90E+04	5.00E+04	MMCL	7.63E+02	FCC
DICHLOROBENZIDINE, 3 3'-		4.50E-01	NC	NC	1.00E+00	82.5		3.10E+03	5.00E+04		5.00E+02	AQUIRE
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)		2.40E-01	NC	NC	1.00E+00	0.08		1.60E+02	5.00E+04		6.00E-01	FAC
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)		3.40E-01	NC	NC	1.00E+00	0.08		4.00E+01	5.00E+04		1.05E+03	USEPA LOEL FAC
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	5.0E-04	3.40E-01	1.00E+00	1.00E+00	1.00E+00	0.05	3.50E+02	3.10E+00	5.00E+04		1.00E-03	FCC
DICHLOROETHANE, 1,1-	1.0E-01		1.30E+00	1.30E+00	NC	0.5		5.50E+06	5.00E+04	ORSGL	2.00E+05	PWQG
DICHLOROETHANE, 1,2-	2.0E-02	9.10E-02	1.00E+00	1.00E+00	1.00E+00	1	2.00E+04	8.69E+06	5.00E+04	MMCL	2.00E+04	FCC
DICHLOROETHYLENE, 1,1-	9.0E-03	6.00E-01	1.00E+00	1.00E+00	1.02E+00	0.5		2.10E+05	5.00E+04	MMCL	1.16E+04	FAC
DICHLOROETHYLENE, CIS-1,2-	1.0E-02		1.00E+00	1.00E+00	NC	0.5		8.00E+05	5.00E+04	MMCL	1.16E+04	FAC
DICHLOROETHYLENE, TRANS-1,2-	2.0E-02		1.00E+00	1.00E+00	NC	0.5	2.60E+02	6.00E+05	5.00E+04	MMCL	1.16E+04	FAC
DICHLOROPHENOL, 2,4-	3.0E-03		1.00E+00	1.00E+00	NC	1.7	3.00E-01	4.50E+06	5.00E+04		3.65E+02	FCC
DICHLOROPROPANE, 1,2-		6.80E-02	NC	NC	1.00E+00	0.5	1.00E+01	2.70E+06	5.00E+04	MMCL	5.70E+03	USEPA LOEL FAC
DICHLOROPROPENE, 1,3-	3.0E-04	1.80E-01	1.00E+00	1.00E+00	1.00E+00	1.4		2.70E+06	5.00E+04	ORSGL	2.44E+02	FCC
DIELDRIN	5.0E-05	1.60E+01	1.00E+00	1.00E+00	1.00E+00	0.02	4.10E+01	1.86E+02	5.00E+04		1.90E-03	FCC
DIETHYL PHTHALATE	8.0E-01		1.00E+00	1.00E+00	NC	4		8.86E+05	5.00E+04		3.00E+00	FCC

											LOWEST	
GROUNDWATER (GW1 AND GW3)	ORAL	ORAL									AMBIENT	
	RfD	CANCER	RAF_Sc	RAF_Sh	RAF_Sa	WATER	ODOR	SOLUBILITY	CEILING	BASIS	WATER	BASIS
	(or substitute)	POTENCY	WATER	WATER	WATER	MDL/PQL	THRESHOLD				QUALITY	
	mg/kg/day	FACTOR	INGEST	INGEST	INGEST	µg/L	µg/L	µg/L			CRITERIA	
CHEMICAL PARAMETER		1/(mg/kg/day)									µg/L	
DIMETHYL PHTHALATE	1.0E+01		1.00E+00	1.00E+00	NC	1.5		5.00E+06	5.00E+04		3.00E+00	FCC
DIMETHYLPHENOL, 2,4-	2.0E-02		1.00E+00	1.00E+00	NC	7.3	4.00E+02	7.87E+06	5.00E+04		2.12E+03	FAC
DINITROPHENOL, 2,4-	2.0E-03		1.00E+00	1.00E+00	NC	42		5.60E+06	5.00E+04		1.50E+02	FCC
DINITROTOLUENE, 2,4-	2.0E-03	6.80E-01	1.00E+00	1.00E+00	1.00E+00	0.5		2.70E+05	5.00E+04		2.30E+02	FCC
ENDOSULFAN	5.0E-05		1.00E+00	1.00E+00	NC	0.12		1.50E+02	5.00E+04		5.60E-02	FCC
ENDRIN	3.0E-04		1.00E+00	1.00E+00	NC	0.05	4.10E+01	2.60E+02	5.00E+04	MMCL	2.30E-03	FCC
ETHYLBENZENE	1.0E-01		1.00E+00	1.00E+00	NC	0.5	2.90E+01	1.61E+05	5.00E+04	MMCL	3.20E+04	USEPA LOEL FAC
ETHYLENE DIBROMIDE	2.0E-05	8.50E+01	1.00E+00	1.00E+00	1.00E+00	1		4.30E+06	5.00E+04	MMCL	2.80E+03	AQUIRE LOEL
FLUORANTHENE	4.0E-02		1.00E+00	1.00E+00	NC	0.2		2.65E+02	5.00E+04		3.98E+03	USEPA LOEL FAC
FLUORENE	4.0E-02		1.00E+00	1.00E+00	NC	1.7		1.90E+03	5.00E+04		2.90E+01	PWQO - LOEL
HEPTACHLOR	5.0E-04	4.50E+00	1.00E+00	1.00E+00	1.00E+00	0.01	2.00E+01	5.60E+01	5.00E+04	MMCL	3.80E-03	FCC
HEPTACHLOR EPOXIDE	1.3E-05	9.10E+00	1.00E+00	1.00E+00	1.00E+00	0.01		3.50E+02	5.00E+04	MMCL	ND	PWQO set on Heptachlor
HEXACHLOROBENZENE	8.0E-04	1.60E+00	1.00E+00	1.00E+00	1.00E+00	0.01	3.00E+03	1.10E+02	5.00E+04	ORSGL	3.68E+00	FCC
HEXACHLOROBUTADIENE	2.0E-03	7.80E-02	1.00E+00	1.00E+00	1.00E+00	0.01	6.00E+00	2.00E+03	5.00E+04		9.30E+00	FCC
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.0E-04	1.30E+00	1.00E+00	1.00E+00	1.00E+00	0.5	1.20E+04	7.00E+03	5.00E+04	MMCL	8.00E-02	FCC
HEXACHLOROETHANE	1.0E-03	1.40E-02	1.00E+00	1.00E+00	1.00E+00	0.01	1.00E+01	5.00E+04	5.00E+04		5.40E+02	FCC
INDENO(1,2,3-cd)PYRENE	4.0E-02	7.30E+00	9.10E-01	9.10E-01	1.00E+00	0.2		5.30E-01	5.00E+04	ORSGL*	ND	
LEAD	7.5E-04		5.00E-01	5.00E-01	NC	0.25		-	5.00E+04	AL-MCL	3.20E+00	FCC
MERCURY	3.0E-04		1.00E+00	1.00E+00	NC	0.02		6.60E+01	5.00E+04	MMCL	1.20E-02	FCC
METHOXYCHLOR	5.0E-03		1.00E+00	1.00E+00	NC	0.05	4.70E+03	4.00E+01	5.00E+04	MMCL	3.00E-02	FCC
METHYL ETHYL KETONE	6.0E-01		1.00E+00	1.00E+00	NC	100	1.00E+03	2.75E+08	5.00E+04	ORSGL	1.20E+05	AQUIRE
METHYL ISOBUTYL KETONE	5.0E-02		1.00E+00	1.00E+00	NC	50		1.91E+07	5.00E+04	ORSGL	4.28E+05	AQUIRE
METHYL MERCURY	3.0E-04		1.00E+00	1.00E+00	NC			-	5.00E+04		1.20E-02	FCC
METHYL TERT BUTYL ETHER	1.0E-01		1.00E+00	1.00E+00	NC	0.5		4.80E+07	5.00E+04	ORSGL	1.00E+05	PWQO - LOEL
METHYLENE CHLORIDE	6.0E-02	7.50E-03	1.00E+00	1.00E+00	1.00E+00	5	9.10E+03	1.67E+07	5.00E+04	ORSGL	1.32E+04	PWQO - LOEL
METHYLNAPHTHALENE, 2-	4.0E-02		1.00E+00	1.00E+00	NC	2.2	1.00E+01	2.60E+04	5.00E+04		1.50E+03	AQUIRE LOEL
MOLYBDENUM						0.25			5.00E+04		7.30E+02	AQUIRE LOEL
NAPHTHALENE	4.0E-02		1.00E+00	1.00E+00	NC	1.6	2.10E+01	3.10E+04	5.00E+04		6.20E+02	FCC
NICKEL	2.0E-02		1.00E+00	1.00E+00	NC	1		-	5.00E+04	ORSGL	1.60E+02	USEPS at hardness of 100 mg/L
PENTACHLOROPHENOL	3.0E-02	1.20E-01	1.00E+00	1.00E+00	1.00E+00	0.1	5.87E+02	1.40E+04	5.00E+04	MMCL	1.30E+01	USEPS at hardness of 100 mg/L
PHENANTHRENE	4.0E-02		9.10E-01	9.10E-01	NC	0.1	1.00E+03	8.16E+02	5.00E+04		6.30E+00	FCC
PHENOL	6.0E-01		1.00E+00	1.00E+00	NC	2.4	7.90E+03	8.00E+07	5.00E+04		2.56E+03	FCC
POLYCHLORINATED BIPHENYLS	2.0E-05	7.70E+00	1.00E+00	1.00E+00	1.00E+00	0.2		3.10E+01	5.00E+04	MMCL	1.40E-02	FCC
PYRENE	3.0E-02		1.00E+00	1.00E+00	NC	0.2		1.60E+02	5.00E+04		4.00E+00	PWQO LOEL
SELENIUM	5.0E-03		1.00E+00	1.00E+00	NC	5		-	5.00E+04	MMCL	5.00E+00	FCC
SILVER	5.0E-03		1.00E+00	1.00E+00	NC	0.25		-	5.00E+04		1.20E-01	FCC
STYRENE	2.0E-01	3.00E-02	1.00E+00	1.00E+00	1.00E+00	0.5	1.10E+01	3.00E+05	5.00E+04	MMCL	ND	
TETRACHLOROETHANE, 1,1,1,2-	3.0E-02	2.60E-02	1.00E+00	1.00E+00	1.00E+00	5		2.00E+05	5.00E+04		9.32E+03	FAC
TETRACHLOROETHANE, 1,1,2,2-	NA	2.00E-01	NC	NC	1.00E+00	1	5.00E+02	2.90E+06	5.00E+04		2.40E+03	FCC
TETRACHLOROETHYLENE	1.0E-02	5.20E-03	1.00E+00	1.00E+00	1.00E+00	0.5	3.00E+02	2.00E+05	5.00E+04	MMCL	8.40E+02	USEPA LOEL FCC
THALLIUM	7.0E-05		1.00E+00	1.00E+00	NC	0.25		-	5.00E+04	ORSGL	4.00E+01	FCC
TOLUENE	2.0E-01		1.00E+00	1.00E+00	NC	0.5	4.00E+01	5.35E+05	5.00E+04	MMCL	1.75E+04	USEPA LOEL FAC
TOTAL PETROLEUM HYDROCARBONS									5.00E+04		--	
TRICHLOROBENZENE, 1,2,4-	1.0E-02		1.00E+00	1.00E+00	NC	0.05		1.90E+04	5.00E+04	ORSGL	5.00E+01	FCC
TRICHLOROETHANE, 1,1,1-	9.0E-02		1.00E+00	1.00E+00	NC	0.5	5.00E+04	7.30E+05	5.00E+04	MMCL	1.80E+04	FAC
TRICHLOROETHANE, 1,1,2-	4.0E-03	5.70E-02	1.00E+00	1.00E+00	1.00E+00	0.6		4.50E+06	5.00E+04	ORSGL	9.40E+03	FCC
TRICHLOROETHYLENE	2.0E-03	1.10E-02	1.00E+00	1.00E+00	1.00E+00	0.5	1.00E+04	1.10E+06	5.00E+04	MMCL	2.19E+04	USEPA LOEL FCC
TRICHLOROPHENOL, 2,4,5-	1.0E-01		1.00E+00	1.00E+00	NC	0.6	2.00E+02	1.19E+06	5.00E+04		8.30E+01	FCC
TRICHLOROPHENOL 2,4,6-	NA	1.10E-02	NC	NC	1.00E+00	0.2	1.00E+02	8.00E+05	5.00E+04		9.70E+02	FCC
VANADIUM						0.25			5.00E+04		2.00E+01	AQUIRE LOEL
VINYL CHLORIDE	1.0E-03	1.90E+00	1.00E+00	1.00E+00	1.53E+00	0.5	3.40E+03	1.10E+03	5.00E+04	MMCL	3.56E+05	ug/L
XYLENES	2.0E+00		1.00E+00	1.00E+00	NC	1.1	5.30E+02	1.71E+05	5.00E+04	MMCL	no data	
ZINC	3.0E-01		1.00E+00	1.00E+00	NC	1		-	5.00E+04		1.10E+02	USEPS at hardness of 100 mg/L

GROUNDWATER (GW1 AND GW3) CHEMICAL PARAMETER	NON-CANCER µg/L	CANCER (EQUATION) µg/L	CANCER VALUE µg/L	LOWEST RISK-BASED µg/L	LOWEST RISK/ODOR BASED µg/L	GW-1 INT HIGHEST: RISK/ODOR, BACKGROUND MDL/PQL µg/L	GW-1 INT LOWEST: CEILING 1/2 SOL. µg/L	GROUNDWATER GW-1 PROPOSED STANDARD (raw value) µg/L	GROUNDWATER GW-1 PROPOSED STANDARD (rounded) µg/L	BASIS
ACENAPHTHENE	4.20E+02	0.00E+00	0.00E+00	4.20E+02	2.00E+01	2.00E+01	2.00E+01	20	20	ODOUR
ACENAPHTHYLENE	3.08E+02	0.00E+00	0.00E+00	3.08E+02	3.08E+02	3.08E+02	3.08E+02	308	308	RISK
ACETONE	7.00E+02	0.00E+00	0.00E+00	7.00E+02	7.00E+02	7.00E+02	7.00E+02	3000	3000	ORSGL
ALDRIN	2.10E-01	2.06E-03	2.06E-03	2.06E-03	2.06E-03	1.00E-02	1.00E-02	0.01	0.01	MDL-DW
ANTHRACENE	2.10E+03	0.00E+00	0.00E+00	2.10E+03	2.10E+03	2.10E+03	6.45E+02	645	645	Solubility
ANTIMONY	2.80E+00	0.00E+00	0.00E+00	2.80E+00	2.80E+00	2.80E+00	2.80E+00	6	6	ORSGL
ARSENIC	2.10E+00	2.00E-02	2.00E-02	2.00E-02	2.00E-02	5.00E-01	5.00E-01	25	25	ODWO
BARIUM								1000	1000	ODWO
BENZENE	3.50E+01	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00	5	5	ODWO
BENZO(a)ANTHRACENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	2.00E-01	2.00E-01	0.2	0.2	ORSGL*
BENZO(a)PYRENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	5.00E-02	5.00E-02	0.01	0.01	ODWO
BENZO(b)FLUORANTHENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	1.00E-01	1.00E-01	0.2	0.2	ORSGL*
BENZO(g,h,i)PERYLENE	3.08E+02	0.00E+00	0.00E+00	3.08E+02	3.08E+02	3.08E+02	1.30E-01	0.2	0.2	MDL-DW
BENZO(k)FLUORANTHENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	1.00E-02	1.00E-02	0.2	0.2	ORSGL*
BERYLLIUM	3.50E+01	8.14E-03	8.14E-03	8.14E-03	8.14E-03	2.50E-01	2.50E-01	4	4	ORSGL
BIPHENYL, 1,1-	3.50E+02	0.00E+00	0.00E+00	3.50E+02	3.50E+02	3.50E+02	3.50E+02	350	350	Threshold
BIS(2-CHLOROETHYL)ETHER	0.00E+00	3.18E-02	3.18E-02	3.18E-02	3.18E-02	4.40E+00	4.40E+00	4.4	4.4	MDL-MISA
BIS(2-CHLOROISOPROPYL)ETHER	2.80E+02	5.00E-01	5.00E-01	5.00E-01	5.00E-01	2.20E+00	2.20E+00	2.2	2.2	MDL-MISA
BIS(2-ETHYLHEXYL)PHTHALATE	1.40E+02	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	6	6	ORSGL
BROMODICHLOROMETHANE	1.40E+02	5.65E-01	5.65E-01	5.65E-01	5.65E-01	8.00E-01	8.00E-01	5	5	ORSGL**
BROMOFORM	1.40E+02	4.43E+00	4.43E+00	4.43E+00	4.43E+00	5.00E+00	5.00E+00	5	5	ORSGL**
BROMOMETHANE	9.80E+00	0.00E+00	0.00E+00	9.80E+00	9.80E+00	9.80E+00	9.80E+00	10	10	ORSGL
CADMIUM	3.50E+00	0.00E+00	0.00E+00	3.50E+00	3.50E+00	3.50E+00	3.50E+00	5	5	ODWO
CARBON TETRACHLORIDE	4.90E+00	2.69E-01	2.69E-01	2.69E-01	2.69E-01	2.00E+00	2.00E+00	5	5	ODWO
CHLORDANE	4.20E-01	2.69E-02	2.69E-02	2.69E-02	2.69E-02	2.69E-02	2.69E-02	7	7	ODWO
CHLOROANILINE, p-	2.80E+01	0.00E+00	0.00E+00	2.80E+01	2.80E+01	2.80E+01	2.80E+01	28	28	RISK
CHLOROBENZENE	1.40E+02	0.00E+00	0.00E+00	1.40E+02	5.00E+01	5.00E+01	5.00E+01	30	30	ODWO
CHLOROFORM	7.00E+01	5.74E+00	5.74E+00	5.74E+00	5.74E+00	5.74E+00	5.74E+00	5	5	ORSGL**
CHLOROPHENOL, 2-	3.50E+01	0.00E+00	0.00E+00	3.50E+01	1.80E-01	3.00E-01	3.00E-01	0.3	0.3	MDL-DW
CHROMIUM(III)	7.00E+03	0.00E+00	0.00E+00	7.00E+03	7.00E+03	7.00E+03	7.00E+03	50	50	ODWO
CHROMIUM(VI)	3.50E+01	0.00E+00	0.00E+00	3.50E+01	3.50E+01	3.50E+01	3.50E+01	50	50	MMCL
CHRYSENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	5.00E-01	5.00E-01	0.2	0.2	ORSGL*
COBALT										
COPPER								1000	1000	ODWO
CYANIDE	1.40E+02	0.00E+00	0.00E+00	1.40E+02	1.40E+02	1.40E+02	1.40E+02	200	200	ODWO
DIBENZO(a,h)ANTHRACENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	1.00E-01	1.00E-01	0.2	0.2	ORSGL*
DIBROMOCHLOROMETHANE	1.40E+02	4.17E-01	4.17E-01	4.17E-01	4.17E-01	2.00E+00	2.00E+00	5	5	ORSGL**
DICHLOROBENZENE, 1,2- (o-DCB)	6.30E+02	0.00E+00	0.00E+00	6.30E+02	1.00E+01	1.00E+01	1.00E+01	3	3	ODWO
DICHLOROBENZENE, 1,3- (m-DCB)	6.30E+02	0.00E+00	0.00E+00	6.30E+02	6.30E+02	6.30E+02	6.30E+02	630	630	RISK
DICHLOROBENZENE, 1,4- (p-DCB)	0.00E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1	1	ODWO
DICHLOROBENZIDINE, 3,3'-	0.00E+00	7.78E-02	7.78E-02	7.78E-02	7.78E-02	8.25E+01	8.25E+01	82.5	82.5	PQL-MASS
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	0.00E+00	1.46E-01	1.46E-01	1.46E-01	1.46E-01	1.46E-01	1.46E-01	30.0	30.0	ODWO
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	0.00E+00	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	30.0	30.0	ODWO
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	3.50E+00	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	30.0	30.0	ODWO
DICHLOROETHANE, 1,1-	5.38E+02	0.00E+00	0.00E+00	5.38E+02	5.38E+02	5.38E+02	5.38E+02	70	70	ORSGL
DICHLOROETHANE, 1,2-	1.40E+02	3.85E-01	3.85E-01	3.85E-01	3.85E-01	1.00E+00	1.00E+00	5	5	ODWO
DICHLOROETHYLENE, 1,1-	6.30E+01	5.72E-02	5.72E-02	5.72E-02	5.72E-02	5.00E-01	5.00E-01	7	7	MMCL
DICHLOROETHYLENE, CIS-1,2-	7.00E+01	0.00E+00	0.00E+00	7.00E+01	7.00E+01	7.00E+01	7.00E+01	70	70	MMCL
DICHLOROETHYLENE, TRANS-1,2-	1.40E+02	0.00E+00	0.00E+00	1.40E+02	1.40E+02	1.40E+02	1.40E+02	100	100	MMCL
DICHLOROPHENOL, 2,4-	2.10E+01	0.00E+00	0.00E+00	2.10E+01	3.00E-01	1.70E+00	1.70E+00	0.3	0.3	ODWO
DICHLOROPROPANE, 1,2-	0.00E+00	5.15E-01	5.15E-01	5.15E-01	5.15E-01	5.15E-01	5.15E-01	5	5	MMCL
DICHLOROPROPENE, 1,3-	2.10E+00	1.94E-01	1.94E-01	1.94E-01	1.94E-01	1.40E+00	1.40E+00	0.5	1.4	MDL-MISA
DIELDRIN	3.50E-01	2.19E-03	2.19E-03	2.19E-03	2.19E-03	2.00E-02	2.00E-02	0.02	0.02	MDL-DW
DIETHYL PHTHALATE	5.60E+03	0.00E+00	0.00E+00	5.60E+03	5.60E+03	5.60E+03	5.60E+03	5600	5600	RISK

GROUNDWATER (GW1 AND GW3) CHEMICAL PARAMETER	NON-CANCER µg/L	CANCER (EQUATION) µg/L	CANCER VALUE µg/L	LOWEST RISK-BASED µg/L	LOWEST RISK/ODOR BASED µg/L	GW-1 INT HIGHEST. RISK/ODOR, BACKGROUND MDL/PQL µg/L	GW-1 INT LOWEST: CEILING 1/2 SOL. µg/L	GROUNDWATER GW-1 PROPOSED STANDARD (raw value) µg/L	GROUNDWATER GW-1 PROPOSED STANDARD (rounded) µg/L	BASIS
DIMETHYL PHTHALATE	7.00E+04	0.00E+00	0.00E+00	7.00E+04	7.00E+04	7.00E+04	5.00E+04	50000	50000	Ceiling
DIMETHYLPHENOL, 2,4-	1.40E+02	0.00E+00	0.00E+00	1.40E+02	1.40E+02	1.40E+02	1.40E+02	140	140	RISK
DINITROPHENOL, 2,4-	1.40E+01	0.00E+00	0.00E+00	1.40E+01	1.40E+01	4.20E+01	4.20E+01	42	42	MDL-DW
DINITROTOLUENE, 2,4-	1.40E+01	5.15E-02	5.15E-02	5.15E-02	5.15E-02	5.00E-01	5.00E-01	0.5	0.5	MDL-DW
ENDOSULFAN	3.50E-01	0.00E+00	0.00E+00	3.50E-01	3.50E-01	3.50E-01	3.50E-01	0.35	0.35	RISK
ENDRIN	2.10E+00	0.00E+00	0.00E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2	2	MMCL
ETHYLBENZENE	7.00E+02	0.00E+00	0.00E+00	7.00E+02	2.90E+01	2.90E+01	2.90E+01	2.4	2.4	ODWO
ETHYLENE DIBROMIDE	1.40E-01	4.12E-04	4.12E-04	4.12E-04	4.12E-04	1.00E+00	1.00E+00	1	1	MDL-DW
FLUORANTHENE	2.80E+02	0.00E+00	0.00E+00	2.80E+02	2.80E+02	2.80E+02	1.33E+02	132.5	132.5	Solubility
FLUORENE	2.80E+02	0.00E+00	0.00E+00	2.80E+02	2.80E+02	2.80E+02	2.80E+02	280	280	RISK
HEPTACHLOR	3.50E+00	7.78E-03	7.78E-03	7.78E-03	7.78E-03	1.00E-02	1.00E-02	3	3	ODWO
HEPTACHLOR EPOXIDE	9.10E-02	3.85E-03	3.85E-03	3.85E-03	3.85E-03	1.00E-02	1.00E-02	3	3	ODWO
HEXACHLOROBENZENE	5.60E+00	2.19E-02	2.19E-02	2.19E-02	2.19E-02	2.19E-02	2.19E-02	1	1	ORSGL
HEXACHLOROBUTADIENE	1.40E+01	4.49E-01	4.49E-01	4.49E-01	4.49E-01	4.49E-01	4.49E-01	0.4	0.4	Cancer
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	2.10E+00	2.69E-02	2.69E-02	2.69E-02	2.69E-02	5.00E-01	5.00E-01	4	4	ODWO
HEXACHLOROETHANE	7.00E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.50E+00	2.5	2.5	Cancer
INDENO(1,2,3-cd)PYRENE	3.08E+02	4.79E-03	4.79E-03	4.79E-03	4.79E-03	2.00E-01	2.00E-01	0.2	0.2	MDL-DW
LEAD	1.05E+01	0.00E+00	0.00E+00	1.05E+01	1.05E+01	1.05E+01	1.05E+01	10	10	ODWO
MERCURY	2.10E+00	0.00E+00	0.00E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	1	1	ODWO
METHOXYCHLOR	3.50E+01	0.00E+00	0.00E+00	3.50E+01	3.50E+01	3.50E+01	2.00E+01	900	900	ODWO
METHYL ETHYL KETONE	4.20E+03	0.00E+00	0.00E+00	4.20E+03	1.00E+03	1.00E+03	1.00E+03	350	350	ORSGL
METHYL ISOBUTYL KETONE	3.50E+02	0.00E+00	0.00E+00	3.50E+02	3.50E+02	3.50E+02	3.50E+02	350	350	ORSGL
METHYL MERCURY	2.10E+00	0.00E+00	0.00E+00	2.10E+00	2.10E+00	2.10E+00	2.10E+00	2.1	2.1	RISK
METHYL TERT BUTYL ETHER	7.00E+02	0.00E+00	0.00E+00	7.00E+02	7.00E+02	7.00E+02	7.00E+02	700	700	ORSGL
METHYLENE CHLORIDE	4.20E+02	4.67E+00	4.67E+00	4.67E+00	4.67E+00	5.00E+00	5.00E+00	50	50	ODWO
METHYLNAPHTHALENE, 2-	2.80E+02	0.00E+00	0.00E+00	2.80E+02	1.00E+01	1.00E+01	1.00E+01	10	10	ODOUR
MOLYBDENUM										
NAPHTHALENE	2.80E+02	0.00E+00	0.00E+00	2.80E+02	2.10E+01	2.10E+01	2.10E+01	21	21	ODOUR
NICKEL	1.40E+02	0.00E+00	0.00E+00	1.40E+02	1.40E+02	1.40E+02	1.40E+02	100	100	ORSGL
PENTACHLOROPHENOL	2.10E+02	2.92E-01	2.92E-01	2.92E-01	2.92E-01	2.92E-01	2.92E-01	30	30	ODWO
PHENANTHRENE	3.08E+02	0.00E+00	0.00E+00	3.08E+02	3.08E+02	3.08E+02	3.08E+02	308	308	RISK
PHENOL	4.20E+03	0.00E+00	0.00E+00	4.20E+03	4.20E+03	4.20E+03	4.20E+03	4200	4200	RISK
POLYCHLORINATED BIPHENYLS	1.40E-01	4.55E-03	4.55E-03	4.55E-03	4.55E-03	2.00E-01	2.00E-01	3	3	ODWO
PYRENE	2.10E+02	0.00E+00	0.00E+00	2.10E+02	2.10E+02	2.10E+02	8.00E+01	80	80	Solubility
SELENIUM	3.50E+01	0.00E+00	0.00E+00	3.50E+01	3.50E+01	3.50E+01	3.50E+01	10	10	ODWO
SILVER	3.50E+01	0.00E+00	0.00E+00	3.50E+01	3.50E+01	3.50E+01	3.50E+01	35	35	RISK
STYRENE	1.40E+03	1.17E+00	1.17E+00	1.17E+00	1.17E+00	1.17E+00	1.17E+00	100	100	MMCL
TETRACHLOROETHANE, 1,1,1,2-	2.10E+02	1.35E+00	1.35E+00	1.35E+00	1.35E+00	5.00E+00	5.00E+00	5	5	PQL-MASS
TETRACHLOROETHANE, 1,1,2,2-	0.00E+00	1.75E-01	1.75E-01	1.75E-01	1.75E-01	1.00E+00	1.00E+00	1	1	MDL-DW
TETRACHLOROETHYLENE	7.00E+01	6.73E+00	6.73E+00	6.73E+00	6.73E+00	6.73E+00	6.73E+00	5	5	MMCL
THALLIUM	4.90E-01	0.00E+00	0.00E+00	4.90E-01	4.90E-01	4.90E-01	4.90E-01	2	2	ORSGL
TOLUENE	1.40E+03	0.00E+00	0.00E+00	1.40E+03	4.00E+01	4.00E+01	4.00E+01	24	24	ODWO
TOTAL PETROLEUM HYDROCARBONS										
TRICHLOROBENZENE, 1,2,4-	7.00E+01	0.00E+00	0.00E+00	7.00E+01	7.00E+01	7.00E+01	7.00E+01	70	70	ORSGL
TRICHLOROETHANE, 1,1,1-	6.30E+02	0.00E+00	0.00E+00	6.30E+02	6.30E+02	6.30E+02	6.30E+02	200	200	MMCL
TRICHLOROETHANE, 1,1,2-	2.60E+01	6.14E-01	6.14E-01	6.14E-01	6.14E-01	6.14E-01	6.14E-01	5	5	ORSGL
TRICHLOROETHYLENE	1.40E+01	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	50	50	ODWO
TRICHLOROPHENOL, 2,4,5-	7.00E+02	0.00E+00	0.00E+00	7.00E+02	2.00E+02	2.00E+02	2.00E+02	200	200	ODOUR
TRICHLOROPHENOL 2,4,6-	0.00E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	3.18E+00	2	2	ODWO
VANADIUM										
VINYL CHLORIDE	7.00E+00	1.20E-02	1.20E-02	1.20E-02	1.20E-02	5.00E-01	5.00E-01	2	2	ODWO
XYLENES	1.40E+04	0.00E+00	0.00E+00	1.40E+04	5.30E+02	5.30E+02	5.30E+02	300	300	ODWO
ZINC	2.10E+03	0.00E+00	0.00E+00	2.10E+03	2.10E+03	2.10E+03	2.10E+03	5000	5000	ODWO

GROUNDWATER (GW1 AND GW3)	AWQC ADJUSTED FOR DILUTION ug/L	GW-3 INT HIGHEST AWQC, PQL, BACKGROUND ug/L	LOWEST GW-3 INT, CEILING 1/2 SOL. ug/L	GROUNDWATER GW-3 PROPOSED STANDARD (raw value) ug/L	GROUNDWATER GW-3 PROPOSED STANDARD (rounded) ug/L	BASIS
CHEMICAL PARAMETER						
ACENAPHTHENE	5.20E+03	5.20E+03	1.71E+03	1.71E+03	1710.00	Solubility
ACENAPHTHYLENE	0.00E+00	5.00E+04	1.97E+03	1.97E+03	1985.00	Solubility
ACETONE	3.30E+03	3.30E+03	3.30E+03	3.30E+03	3300.00	AWQC
ALDRIN	3.00E+01	3.00E+01	8.50E+00	8.50E+00	8.50	Solubility
ANTHRACENE	1.20E+01	1.20E+01	1.20E+01	1.20E+01	12.00	LOEL
ANTIMONY	1.60E+04	1.60E+04	1.60E+04	1.60E+04	16000.00	AWQC
ARSENIC	4.80E+02	4.80E+02	4.80E+02	4.80E+02	480.00	AWQC
BARIUM	2.30E+04	2.30E+04	2.30E+04	2.30E+04	23000.00	LOEL
BENZENE	5.30E+04	5.30E+04	5.00E+04	5.00E+04	50000.00	Ceiling
BENZO(a)ANTHRACENE	1.80E+01	1.80E+01	5.00E+00	5.00E+00	5.00	Solubility
BENZO(a)PYRENE	2.10E+00	2.10E+00	1.90E+00	1.90E+00	1.90	Solubility
BENZO(b)FLUORANTHENE	0.00E+00	5.00E+04	7.00E+00	7.00E+00	7.00	Solubility
BENZO(g,h,i)PERYLENE	2.00E+00	2.00E+00	1.30E-01	1.30E-01	0.13	Solubility
BENZO(k)FLUORANTHENE	7.40E+01	7.40E+01	4.00E-01	4.00E-01	0.40	Solubility
BERYLLIUM	5.30E+01	5.30E+01	5.30E+01	5.30E+01	53.00	AWQC
BIPHENYL, 1,1-	1.70E+03	1.70E+03	1.70E+03	1.70E+03	1700.00	LOEL
BIS(2-CHLOROETHYL)ETHER	2.38E+06	2.38E+06	5.00E+04	5.00E+04	50000.00	Ceiling
BIS(2-CHLOROISOPROPYL)ETHER	2.38E+06	2.38E+06	5.00E+04	5.00E+04	50000.00	Ceiling
BIS(2-ETHYLHEXYL)PHTHALATE	3.00E+01	3.00E+01	3.00E+01	3.00E+01	30.00	AWQC
BROMODICHLOROMETHANE	6.70E+05	6.70E+05	5.00E+04	5.00E+04	50000.00	Ceiling
BROMOFORM	2.90E+05	2.90E+05	5.00E+04	5.00E+04	50000.00	Ceiling
BROMOMETHANE	3.20E+03	3.20E+03	3.20E+03	3.20E+03	3200.00	LOEL
CADMIUM	1.10E+01	1.10E+01	1.10E+01	1.10E+01	11.00	AWQC
CARBON TETRACHLORIDE	3.52E+05	3.52E+05	5.00E+04	5.00E+04	50000.00	Ceiling
CHLORDANE	4.00E-02	4.00E-02	4.00E-02	4.00E-02	0.04	AWQC
CHLOROANILINE, p-	1.00E+02	1.00E+02	1.00E+02	1.00E+02	100.00	LOEL
CHLOROBENZENE	5.00E+02	5.00E+02	5.00E+02	5.00E+02	500.00	AWQC
CHLOROFORM	1.24E+04	1.24E+04	1.24E+04	1.24E+04	12400.00	AWQC
CHLOROPHENOL, 2-	4.38E+04	4.38E+04	4.38E+04	4.38E+04	43800.00	AWQC
CHROMIUM(III)	2.00E+03	2.00E+03	2.00E+03	2.00E+03	2000.00	LOEL
CHROMIUM(VI)	1.10E+02	1.10E+02	1.10E+02	1.10E+02	110.00	AWQC
CHRYSENE	7.00E+00	7.00E+00	3.00E+00	3.00E+00	3.00	Solubility
COBALT	1.00E+02	1.00E+02	1.00E+02	1.00E+02	100.00	LOEL
COPPER	2.30E+01	2.30E+01	2.30E+01	2.30E+01	23.00	LOEL
CYANIDE	5.20E+01	5.20E+01	5.20E+01	5.20E+01	52.00	AWQC
DIBENZO(a,h)ANTHRACENE	1.50E+02	1.50E+02	2.50E-01	2.50E-01	0.25	Solubility
DIBROMOCHLOROMETHANE	6.50E+05	6.50E+05	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROBENZENE, 1,2- (o-DCB)	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7630.00	AWQC
DICHLOROBENZENE, 1,3- (m-DCB)	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7630.00	AWQC
DICHLOROBENZENE, 1,4- (p-DCB)	7.63E+03	7.63E+03	7.63E+03	7.63E+03	7630.00	AWQC
DICHLOROBENZIDINE, 3,3'-	5.00E+03	5.00E+03	1.55E+03	1.55E+03	1550.00	Solubility
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	6.00E+00	6.00E+00	6.00E+00	6.00E+00	6.00	AWQC
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	1.05E+04	1.05E+04	2.00E+01	2.00E+01	20.00	Solubility
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	1.00E-02	5.00E-02	5.00E-02	5.00E-02	0.05	MDL-DW
DICHLOROETHANE, 1,1-	2.00E+06	2.00E+06	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROETHANE 1,2-	2.00E+05	2.00E+05	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROETHYLENE, 1,1-	1.16E+05	1.16E+05	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROETHYLENE, CIS-1,2-	1.16E+05	1.16E+05	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROETHYLENE, TRANS-1,2-	1.16E+05	1.16E+05	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROPHENOL, 2,4-	3.65E+03	3.65E+03	3.65E+03	3.65E+03	3650.00	AWQC
DICHLOROPROPANE, 1,2-	5.70E+04	5.70E+04	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROPROPENE, 1,3-	2.44E+03	2.44E+03	2.44E+03	2.44E+03	2440.00	AWQC
DIELDRIN	1.90E-02	2.00E-02	2.00E-02	2.00E-02	0.02	MDL-DW
DIETHYL PHTHALATE	3.00E+01	3.00E+01	3.00E+01	3.00E+01	30.00	AWQC

GROUNDWATER (GW1 AND GW3) CHEMICAL PARAMETER	AWQC ADJUSTED FOR DILUTION ug/L	GW-3 INT HIGHEST AWQC, PQL, BACKGROUND ug/L	LOWEST GW-3 INT, CEILING 1/2 SOL ug/L	GROUNDWATER GW-3 PROPOSED STANDARD (raw value) ug/L	GROUNDWATER GW-3 PROPOSED STANDARD (rounded) ug/L	BASIS
DIMETHYL PHTHALATE	3.00E+01	3.00E+01	3.00E+01	3.00E+01	30.00	AWQC
DIMETHYLPHENOL, 2,4-	2.12E+04	2.12E+04	2.12E+04	2.12E+04	21200.00	AWQC
DINITROPHENOL, 2,4-	1.50E+03	1.50E+03	1.50E+03	1.50E+03	1500.00	AWQC
DINITROTOLUENE, 2,4-	2.30E+03	2.30E+03	2.30E+03	2.30E+03	2300.00	AWQC
ENDOSULFAN	5.60E-01	5.60E-01	5.60E-01	5.60E-01	0.56	AWQC
ENDRIN	2.30E-02	5.00E-02	5.00E-02	5.00E-02	0.05	MDL-DW
ETHYLBENZENE	3.20E+05	3.20E+05	5.00E+04	5.00E+04	50000.00	Ceiling
ETHYLENE DIBROMIDE	2.80E+04	2.80E+04	2.80E+04	2.80E+04	28000.00	LOEL
FLUORANTHENE	3.98E+04	3.98E+04	1.33E+02	1.33E+02	132.50	Solubility
FLUORENE	2.90E+02	2.90E+02	2.90E+02	2.90E+02	290.00	LOEL
HEPTACHLOR	3.80E-02	3.80E-02	3.80E-02	3.80E-02	0.04	AWQC
HEPTACHLOR EPOXIDE	0.00E+00	5.00E+04	1.75E+02	1.75E+02	175.00	Solubility
HEXACHLOROBENZENE	3.68E+01	3.68E+01	3.68E+01	3.68E+01	36.80	AWQC
HEXACHLOROBUTADIENE	9.30E+01	9.30E+01	9.30E+01	9.30E+01	93.00	AWQC
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	8.00E-01	8.00E-01	8.00E-01	8.00E-01	0.80	AWQC
HEXACHLOROETHANE	5.40E+03	5.40E+03	5.40E+03	5.40E+03	5400.00	AWQC
INDENO(1,2,3-cd)PYRENE	0.00E+00	5.00E+04	2.65E-01	2.65E-01	0.27	Solubility
LEAD	3.20E+01	3.20E+01	3.20E+01	3.20E+01	32.00	AWQC
MERCURY	1.20E-01	1.20E-01	1.20E-01	1.20E-01	0.12	AWQC
METHOXYCHLOR	3.00E-01	3.00E-01	3.00E-01	3.00E-01	0.30	AWQC
METHYL ETHYL KETONE	1.20E+06	1.20E+06	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL ISOBUTYL KETONE	4.28E+06	4.28E+06	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL MERCURY	1.20E-01	1.20E-01	1.20E-01	1.20E-01	0.12	AWQC
METHYL TERT BUTYL ETHER	1.00E+06	1.00E+06	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLENE CHLORIDE	1.32E+05	1.32E+05	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLNAPHTHALENE, 2-	1.50E+04	1.50E+04	1.30E+04	1.30E+04	13000.00	Solubility
MOLYBDENUM	7.30E+03	7.30E+03	7.30E+03	7.30E+03	7300.00	LOEL
NAPHTHALENE	6.20E+03	6.20E+03	6.20E+03	6.20E+03	6200.00	AWQC
NICKEL	1.60E+03	1.60E+03	1.60E+03	1.60E+03	1600.00	LOEL
PENTACHLOROPHENOL	1.30E+02	1.30E+02	1.30E+02	1.30E+02	130.00	LOEL
PHENANTHRENE	6.30E+01	6.30E+01	6.30E+01	6.30E+01	63.00	AWQC
PHENOL	2.56E+04	2.56E+04	2.56E+04	2.56E+04	25600.00	AWQC
POLYCHLORINATED BIPHENYLS	1.40E-01	2.00E-01	2.00E-01	2.00E-01	0.20	MDL-DW
PYRENE	4.00E+01	4.00E+01	4.00E+01	4.00E+01	40.00	LOEL
SELENIUM	5.00E+01	5.00E+01	5.00E+01	5.00E+01	50.00	AWQC
SILVER	1.20E+00	1.20E+00	1.20E+00	1.20E+00	1.20	AWQC
STYRENE	0.00E+00	5.00E+04	5.00E+04	5.00E+04	50000.00	Ceiling
TETRACHLOROETHANE, 1,1,1,2-	9.32E+04	9.32E+04	5.00E+04	5.00E+04	50000.00	Ceiling
TETRACHLOROETHANE, 1,1,2,2-	2.40E+04	2.40E+04	2.40E+04	2.40E+04	24000.00	AWQC
TETRACHLOROETHYLENE	8.40E+03	8.40E+03	8.40E+03	8.40E+03	8400.00	AWQC
THALLIUM	4.00E+02	4.00E+02	4.00E+02	4.00E+02	400.00	AWQC
TOLUENE	1.75E+05	1.75E+05	5.00E+04	5.00E+04	50000.00	Ceiling
TOTAL PETROLEUM HYDROCARBONS	0.00E+00	5.00E+04	5.00E+04	5.00E+04	50000.00	Ceiling
TRICHLOROBENZENE, 1,2,4-	5.00E+02	5.00E+02	5.00E+02	5.00E+02	500.00	AWQC
TRICHLOROETHANE, 1,1,1-	1.80E+05	1.80E+05	5.00E+04	5.00E+04	50000.00	Ceiling
TRICHLOROETHANE, 1,1,2-	9.40E+04	9.40E+04	5.00E+04	5.00E+04	50000.00	Ceiling
TRICHLOROETHYLENE	2.19E+05	2.19E+05	5.00E+04	5.00E+04	50000.00	Ceiling
TRICHLOROPHENOL, 2,4,5-	6.30E+02	6.30E+02	6.30E+02	6.30E+02	630.00	AWQC
TRICHLOROPHENOL 2,4,6-	9.70E+03	9.70E+03	9.70E+03	9.70E+03	9700.00	AWQC
VANADIUM	2.00E+02	2.00E+02	2.00E+02	2.00E+02	200.00	LOEL
VINYL CHLORIDE	3.56E+06	3.56E+06	5.50E+02	5.50E+02	550.00	Solubility
XYLENES	0.00E+00	5.00E+04	5.00E+04	5.00E+04	50000.00	Ceiling
ZINC	1.10E+03	1.10E+03	1.10E+03	1.10E+03	1100.00	LOEL

Appendix B.1.7: Derivation of GW-2 Groundwater Concentrations. (for Coarse Textured Soil Situation).

GROUNDWATER (GW-2)

FOR COARSE TEXTURED SOIL SITUATION

CHEMICAL PARAMETER	CHRONIC INHALATION REFERENCE CONC. (or substitute) ug/cu m	INHALATION CANCER UNIT RISK 1/(ug/cu m)	20% RIC ug/cu m	1E-06 ELCR LEVEL ug/cu m	LOWEST RISK LEVEL ug/cu m	INDOOR AIR BACKGROUND ug/cu m (vapors)	HENRY'S LAW CONSTANT atm-m3/mol	MOLECULAR WEIGHT g/mole	ODOUR THRESHOLD ug/cu m	CEILING ug/L	WATER PQL ug/L	SOLUBILITY ug/l	LOWEST RISK, Odour (air) ug/cu m	HIGHER BACKGROUND, (risk, odour) ug/cu m	ATTENUATION FACTOR (alpha)
ACETONE	8.0E+02		2E+02	0.00E+00	2E+02	6	4 26E-05	5.80E+01	3 09E+04	5.00E+04	0.01	1.00E+09	160 0000	1.60E+02	5 00E-04
ALDRIN		4.9E-03	0E+00	2.04E-04	2E-04		4.96E-04	3.65E+02	2 63E+02	5.00E+04	0.01	1.70E+01	0 0002	2.04E-04	5 00E-04
BENZENE	9.0E+00	8.3E-06	2E+00	1.20E-01	1E-01	2.10E+01	5.50E-03	7.80E+01	4.89E+03	5.00E+04	0.5	1.78E+06	0.1205	2.10E+01	5.00E-04
BENZO(a)PYRENE		1.7E-03	0E+00	5.88E-04	6E-04	0.00E+00	4.90E-07	2.52E+02		5.00E+04	0.05	3.80E+00	0 0006	5 88E-04	5.00E-04
BIS(2-CHLOROETHYL)ETHER		3.3E-04	0E+00	3.03E-03	3E-03		1.30E-05	1.43E+02	2.87E+02	5 00E+04	4.4	1.02E+07	0 0030	3 03E-03	5 00E-04
BIS(2-CHLOROISOPROPYL)ETHER		1.0E-05	0E+00	1.00E-01	1E-01		1.13E-04	1.71E+02	2.24E+03	5.00E+04	2.2	1.70E+06	0.1000	1.00E-01	5.00E-04
BIS(2-ETHYLHEXYL)PHTHALATE	7.0E+00	1.3E-06	1E+00	7.69E-01	8E-01	0.00E+00	3.00E-07	3.91E+02		5.00E+04	2.2	1.30E+03	0 7692	7 69E-01	5.00E-04
BROMOFORM		1.1E-06	0E+00	9.09E-01	9E-01		6.32E-04	2.53E+02	1.35E+04	5.00E+04	5	3.20E+06	0 9091	9.09E-01	5 00E-04
BROMOMETHANE	5.0E+00		1E+00	0.00E+00	1E+00		1.97E-01	9.50E+01	8.00E+04	5.00E+04	3.7	1.75E+07	1.0000	1.00E+00	5.00E-04
CARBON TETRACHLORIDE	4.3E+02	1.5E-05	9E+01	6.67E-02	7E-02	1.00E+00	2.93E-02	1.54E+02	6.30E+04	5.00E+04	2	8.00E+05	0.0667	1.00E+00	5.00E-04
CHLORDANE	7.0E-01	3.7E-04	1E-01	2.70E-03	3E-03		4.79E-05	4.10E+02	8.40E+00	5 00E+04	0.02	5.60E+01	0.0027	2.70E-03	5.00E-04
CHLOROBENZENE	2 0E+01		4E+00	0.00E+00	4E+00	1.00E+01	3.93E-03	1.13E+02	1.00E+03	5.00E+04	0.5	4.88E+05	4.0000	1.00E+01	5.00E-04
CHLOROFORM	6.6E+02	2.3E-05	1E+02	4.35E-02	4E-02	3.00E+00	3 39E-03	1.19E+02	4.22E+05	5.00E+04	1	9 30E+06	0 0435	3.00E+00	5.00E-04
DICHLOROBENZENE, 1,2- (o-DCB)	2.0E+02		4E+01	0.00E+00	4E+01	1	1.94E-03	1.47E+02	3.05E+05	5.00E+04	0.5	1.45E+05	40.0000	4.00E+01	5.00E-04
DICHLOROBENZENE, 1,3- (m-DCB)															
DICHLOROBENZENE, 1,4- (p-DCB)	8.0E+02		2E+02	0.00E+00	2E+02	0.5	2.72E-03	1.47E+02	1.10E+03	5.00E+04	0.5	7.90E+04	160.0000	1.60E+02	5.00E-04
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)		9.7E-05	0E+00	1.03E-02	1E-02		3.89E-05	3.54E+02		5.00E+04	0.05	3.10E+00	0 0103	1.03E-02	5 00E-04
DICHLOROETHANE, 1,1-	5.0E+02		1E+02	0.00E+00	1E+02	0 00E+00	5.45E-03	9.90E+01	1.25E+05	5.00E+04	0.5	5.50E+06	100.0000	1.00E+02	5.00E-04
DICHLOROETHANE, 1,2-	5.5E+01	2.6E-05	1E+01	3.85E-02	4E-02	0 00E+00	1.10E-03	9.90E+01	2.42E+03	5.00E+04	1	8.69E+06	0.0385	3.85E-02	5.00E-04
DICHLOROETHYLENE, 1,1-	5.0E+00	5 0E-05	1E+00	2.00E-02	2E-02	0.00E+00	1.49E-02	9.70E+01	1.25E+05	5 00E+04	0.5	2.10E+05	0.0200	2 00E-02	5.00E-04
DICHLOROPROPANE, 1,2-	4.0E+00	1.9E-05	8E-01	5 35E-02	5E-02		2 82E-03	1.13E+02	1.19E+03	5.00E+04	0.5	2 70E+06	0 0535	5.35E-02	5 00E-04
DICHLOROPROPENE, 1,3-	2.0E+01	3.7E-05	4E+00	2.70E-02	3E-02		3 50E-03	1.11E+02	4.61E+03	5.00E+04	1.4	2.70E+06	0 0270	2.70E-02	5 00E-04
DIELDRIN		4.6E-03	0E+00	2.17E-04	2E-04		5.84E-05	3.81E+02		5.00E+04	0.02	1.86E+02	0 0002	2.17E-04	5.00E-04
ETHYLBENZENE	1.0E+03		2E+02	0.00E+00	2E+02	1.00E+01	3.43E-03	1.06E+02	2.00E+03	5.00E+04	0.5	1.61E+05	200 0000	2.00E+02	5 00E-04
ETHYLENE DIBROMIDE	2.0E-01	2.2E-04	4E-02	4.55E-03	5E-03	0.00E+00	6.73E-04	1.88E+02	2.00E+05	5.00E+04	1	4.30E+06	0.0045	4.55E-03	5.00E-04
HEPTACHLOR	7.0E-01	1.3E-03	1E-01	7.69E-04	8E-04		1.48E-03	3.74E+02	3.00E+02	5.00E+04	0.01	5.60E+01	0.0008	7.69E-04	5.00E-04
HEPTACHLOR EPOXIDE		2.6E-03	0E+00	3 85E-04	4E-04		3.16E-05	3.89E+02	3.00E+02	5.00E+04	0.01	3 50E+02	0 0004	3 85E-04	5 00E-04
HEXACHLOROBENZENE		4.6E-04	0E+00	2.17E-03	2E-03		1.70E-03	2.85E+02		5.00E+04	0.01	1.10E+02	0.0022	2.17E-03	5 00E-04
HEXACHLOROBUTADIENE		2 2E-05	0E+00	4.55E-02	5E-02		2.56E-02	2.61E+02	1.20E+04	5.00E+04	0.01	2.00E+03	0.0455	4.55E-02	5.00E-04
HEXACHLOROETHANE	3.0E+00	4.0E-06	6E-01	2.50E-01	3E-01		9.85E-03	2.37E+02		5.00E+04	0.01	5.00E+04	0.2500	2.50E-01	5 00E-04
METHYL ETHYL KETONE	1.0E+03		2E+02	0.00E+00	2E+02	4.20E+01	5.77E-05	7.20E+01	3.20E+04	5.00E+04	100	2.75E+08	200 0000	2.00E+02	5.00E-04
METHYL ISOBUTYL KETONE	8.0E+01		2E+01	0.00E+00	2E+01	2.00E+00	1.38E-04	1.00E+02	9.70E+03	5.00E+04	50	1.91E+07	16.0000	1.60E+01	5.00E-04
METHYL TERT BUTYL ETHER	5.0E+02		1E+02	0.00E+00	1E+02	0.00E+00	5.91E-04	8.80E+01		5.00E+04	0.5	4.80E+07	100 0000	1.00E+02	5.00E-04
METHYLENE CHLORIDE	3 0E+03	4.7E-07	6E+02	2.13E+00	2E+00	6.00E+02	3.19E-03	8.50E+01	5.40E+05	5.00E+04	5	1.67E+07	2.1277	6.00E+02	5.00E-04
METHYLNAPHTHALENE, 2-	7.1E+01		1E+01	0.00E+00	1E+01	0.00E+00	2.90E-04	1.42E+02	6 80E+01	5.00E+04	2.2	2.60E+04	14 2000	1.42E+01	5.00E-04
NAPHTHALENE	7.1E+01		1E+01	0.00E+00	1E+01	5.00E+00	1.18E-03	1.28E+02	4.40E+02	5.00E+04	1.6	3.10E+04	14.2000	1.42E+01	5.00E-04
PENTACHLOROPHENOL	7 0E-02		1E-02	0 00E+00	1E-02		2.80E-06	2.66E+02		5.00E+04	0.1	1.40E+04	0.0140	1.40E-02	5.00E-04
PHENOL	2.6E+02		5E+01	0.00E+00	5E+01	0.00E+00	1.30E-06	9.40E+01	1.57E+02	5.00E+04	2.4	8.00E+07	52.0000	5 20E+01	5 00E-04
POLYCHLORINATED BIPHENYS	2.0E-02		4E-03	0.00E+00	4E-03	0.00E+00	2.00E-03	varies		5.00E+04	0.2	3.10E+01	0.0040	4.00E-03	5 00E-04
STYRENE	1.0E+03	5.7E-07	2E+02	1.75E+00	2E+00	5.00E+00	2.61E-03	1.04E+02	1.36E+03	5.00E+04	0.5	3.00E+05	1.7544	5.00E+00	5 00E-04
TETRACHLOROETHANE, 1,1,1,2-		7.4E-06	0E+00	1.35E-01	1E-01		1.10E-02	1.68E+02		5.00E+04	5	2 00E+05	0.1351	1.35E-01	5.00E-04
TETRACHLOROETHANE, 1,1,2,2-	9.3E+01	5 8E-05	2E+01	1.72E-02	2E-02	0.01	3.80E-04	1.68E+02	1.05E+04	5.00E+04	1	2.90E+06	0.0172	1.72E-02	5.00E-04
TETRACHLOROETHYLENE	4.6E+03	5 2E-07	9E+02	1.92E+00	2E+00	1.10E+01	2.04E-03	1.66E+02	3.17E+04	5.00E+04	0.5	2.00E+05	1.9231	1.10E+01	5.00E-04
TOLUENE	4 0E+02		8E+01	0 00E+00	8E+01	2.90E+01	6.68E-03	9.20E+01	3.00E+04	5.00E+04	0 5	5.35E+05	80 0000	8 00E+01	5 00E-04
TRICHLOROBENZENE, 1,2,4-	9 0E+00		2E+00	0.00E+00	2E+00	0.04	1 42E-03	1.81E+02	2.20E+04	5.00E+04	0 05	1.90E+04	1.8000	1 80E+00	5 00E-04
TRICHLOROETHANE, 1,1,1-	1.0E+03		2E+02	0.00E+00	2E+02	3.00E+01	2.31E-02	1.33E+02	6.51E+04	5.00E+04	0.5	7.30E+05	200 0000	2 00E+02	5 00E-04
TRICHLOROETHANE, 1,1,2-	7.4E+01	1.6E-05	1E+01	6 25E-02	6E-02	3.00E+01	9.10E-04	1.33E+02		5.00E+04	0 6	4.50E+06	0 0625	3 00E+01	5.00E-04
TRICHLOROETHYLENE	1.8E+02	1 7E-06	4E+01	5.88E-01	6E-01	5.00E+00	9.12E-03	1.31E+02	1.36E+06	5.00E+04	0.5	1.10E+06	0.5882	5 00E+00	5.00E-04
TRICHLOROPHENOL 2,4,6-		3.1E-06	0E+00	3 23E-01	3E-01		4.00E-06	1 97E+02	3.00E-01	5 00E+04	0.2	8 00E+05	0 3000	3.00E-01	5.00E-04
VINYL CHLORIDE	1.7E+01	8.4E-05	3E+00	1.19E-02	1E-02	0.00E+00	2.78E-02	6.30E+01	7.71E+05	5.00E+04	0.5	1.10E+03	0 0119	1.19E-02	5 00E-04
XYLENES	3 0E+02		6E+01	0 00E+00	6E+01	3	5 27E-03	1.06E+02	4.41E+02	5 00E+04	1.1	1.71E+05	60.0000	6.00E+01	5 00E-04

GROUNDWATER (GW-2)

FOR COARSE TEXTURED SOIL SITUATION

CHEMICAL PARAMETER	SOURCE DILUTION FACTOR (d)	HENRY'S LAW CONSTANT conc/conc	UNITS CONVERSION l/cu m	VOLATILITY BASED VALUE µg/L	GW-2 INT HIGHEST VOL VALUE, MDL/PQL, BCKGRND µg/L	LOWEST GW-2 INT, CEILING, 1/2 SOL. µg/L	GROUNDWATER GW-2 PROPOSED STANDARD (raw value) ug/L	GROUNDWATER GW-2 PROPOSED STANDARD (Rounded) ug/L	BASIS
ACETONE	1.00E-01	2E-03	1000	1835568	1835568	5.00E+04	5.00E+04	50000.00	Ceiling
ALDRIN	1.00E-01	2E-02	1000	0	0	2.01E-01	2.01E-01	0 20	Risk
BENZENE	1.00E-01	2E-01	1000	1866	1866	1.87E+03	1.87E+03	1866 02	Bckgrnd-Air
BENZO(a)PYRENE	1.00E-01	2E-05	1000	587	587	1.90E+00	1.90E+00	1.90	Solubility
BIS(2-CHLOROETHYL)ETHER	1.00E-01	5E-04	1000	114	114	1.14E+02	1.14E+02	113.92	Risk
BIS(2-CHLOROISOPROPYL)ETHER	1 00E-01	5E-03	1000	432	432	4.32E+02	4.32E+02	432.50	Risk
BIS(2-ETHYLHEXYL)PHTHALATE	1 00E-01	1E-05	1000	1253128	1253128	6.50E+02	6.50E+02	650.00	Solubility
BROMOFORM	1.00E-01	2E-02	1000	835	835	8.35E+02	8 35E+02	835 13	Risk
BROMOMETHANE	1.00E-01	8E+00	1000	2	4	3.70E+00	3.70E+00	3.70	MDL-MISA
CARBON TETRACHLORIDE	1.00E-01	1E+00	1000	17	17	1.67E+01	1.67E+01	16.68	Bckgrnd-Air
CHLORDANE	1.00E-01	2E-03	1000	28	28	2.76E+01	2.76E+01	27.58	Risk
CHLOROBENZENE	1.00E-01	2E-01	1000	1244	1244	1.24E+03	1.24E+03	1243.56	Bckgrnd-Air
CHLOROFORM	1.00E-01	1E-01	1000	432	432	4.32E+02	4.32E+02	432.50	Bckgrnd-Air
DICHLOROBENZENE, 1,2- (o-DCB)	1 00E-01	8E-02	1000	10077	10077	1.01E+04	1.01E+04	10076.70	Risk
DICHLOROBENZENE, 1,3- (m-DCB)								10076.70	Risk (o-DCB)
DICHLOROBENZENE, 1,4- (p-DCB)	1.00E-01	1E-01	1000	28748	28748	2.87E+04	2 87E+04	28748 24	Risk
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)	1 00E-01	2E-03	1000	130	130	1.55E+00	1.55E+00	1.55	Solubility
DICHLOROETHANE, 1,1-	1.00E-01	2E-01	1000	8967	8967	8 97E+03	8 97E+03	8967.34	Risk
DICHLOROETHANE, 1,2-	1.00E-01	5E-02	1000	17	17	1.71E+01	1.71E+01	17.09	Risk
DICHLOROETHYLENE, 1,1-	1.00E-01	6E-01	1000	1	1	6.56E-01	6 56E-01	0 66	Risk
DICHLOROPROPANE, 1,2-	1.00E-01	1E-01	1000	9	9	9.27E+00	9.27E+00	9 27	Risk
DICHLOROPROPENE, 1,3-	1.00E-01	1E-01	1000	4	4	3.77E+00	3.77E+00	3.77	Risk
DIELDRIN	1 00E-01	2E-03	1000	2	2	1.82E+00	1.82E+00	1.82	Risk
ETHYLBENZENE	1 00E-01	1E-01	1000	28497	28497	2.85E+04	2 85E+04	28496.79	Risk
ETHYLENE DIBROMIDE	1.00E-01	3E-02	1000	3	3	3 30E+00	3 30E+00	3 30	Risk
HEPTACHLOR	1.00E-01	6E-02	1000	0	0	2.54E-01	2 54E-01	0.25	Risk
HEPTACHLOR EPOXIDE	1 00E-01	1E-03	1000	6	6	5.95E+00	5 95E+00	5 95	Risk
HEXACHLOROBENZENE	1 00E-01	7E-02	1000	1	1	6 25E-01	6 25E-01	0 62	Risk
HEXACHLOROBUTADIENE	1.00E-01	1E+00	1000	1	1	8 68E-01	8.68E-01	0 87	Risk
HEXACHLOROETHANE	1.00E-01	4E-01	1000	12	12	1.24E+01	1.24E+01	12 40	Risk
METHYL ETHYL KETONE	1.00E-01	2E-03	1000	1694003	1694003	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL ISOBUTYL KETONE	1.00E-01	6E-03	1000	56663	56663	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL TERT BUTYL ETHER	1.00E-01	2E-02	1000	82694	82694	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLENE CHLORIDE	1.00E-01	1E-01	1000	91922	91922	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLNAPHTHALENE, 2-	1.00E-01	1E-02	1000	23930	23930	1.30E+04	1.30E+04	13000.00	Solubility
NAPHTHALENE	1.00E-01	5E-02	1000	5881	5881	5.88E+03	5.88E+03	5881.21	Risk
PENTACHLOROPHENOL	1.00E-01	1E-04	1000	2444	2444	2 44E+03	2 44E+03	2443 60	Risk
PHENOL	1.00E-01	5E-05	1000	19548800	19548800	5.00E+04	5.00E+04	50000.00	Ceiling
POLYCHLORINATED BIPHENYS	1.00E-01	8E-02	1000	1	1	9.77E-01	9 77E-01	0 98	Risk
STYRENE	1.00E-01	1E-01	1000	936	936	9.36E+02	9.36E+02	936 25	Bckgrnd-Air
TETRACHLOROETHANE, 1,1,1,2-	1.00E-01	5E-01	1000	6	6	6.00E+00	6.00E+00	6.00	Risk
TETRACHLOROETHANE, 1,1,2,2-	1 00E-01	2E-02	1000	22	22	2.22E+01	2 22E+01	22.17	Risk
TETRACHLOROETHYLENE	1 00E-01	8E-02	1000	2635	2635	2.64E+03	2.64E+03	2635 25	Bckgrnd-Air
TOLUENE	1.00E-01	3E-01	1000	5853	5853	5.85E+03	5.85E+03	5852 93	Risk
TRICHLOROBENZENE, 1,2,4-	1.00E-01	6E-02	1000	620	620	6.20E+02	6.20E+02	619 50	Risk
TRICHLOROETHANE, 1,1,1-	1.00E-01	9E-01	1000	4231	4231	4.23E+03	4.23E+03	4231.34	Risk
TRICHLOROETHANE, 1,1,2-	1.00E-01	4E-02	1000	16112	16112	1.61E+04	1.61E+04	16111 65	Bckgrnd-Air
TRICHLOROETHYLENE	1.00E-01	4E-01	1000	268	268	2.68E+02	2.68E+02	267.94	Bckgrnd-Air
TRICHLOROPHENOL 2,4,6-	1.00E-01	2E-04	1000	36654	36654	3.67E+04	3.67E+04	36654.00	Odour
VINYL CHLORIDE	1.00E-01	1E+00	1000	0	1	5.00E-01	5.00E-01	0 50	MDL-DW
XYLENES	1.00E-01	2E-01	1000	5564	5564	5.56E+03	5.56E+03	5564.17	Risk

Appendix B.1.8: Derivation of GW-2 Groundwater Concentrations. (for Medium/Fine Textured Soil Situation).

GROUNDWATER (GW-2)
FOR MEDIUM/FINE TEXTURED SOIL SITUATION

CHEMICAL PARAMETER	CHRONIC INHALATION REFERENCE CONC. (or substitute) ug/cu m	INHALATION CANCER UNIT RISK 1/(ug/cu m)	20% RIC ug/cu m	1E-06 ELCR LEVEL ug/cu m	LOWEST RISK LEVEL ug/cu m	INDOOR AIR BACKGROUND ug/cu m (vapors)	HENRY'S LAW CONSTANT atm-m3/mol	MOLECULAR WEIGHT g/mole	ODOUR THRESHOLD ug/cu m	CEILING ug/L	WATER PQL ug/L	SOLUBILITY ug/l	LOWEST RISK, Odour (air) ug/cu m	HIGHER BACKGROUND, (risk, odour) ug/cu m	ATTENUATION FACTOR (alpha)
ACETONE	8.0E+02		2E+02	0.00E+00	2E+02	6	4.26E-05	5.80E+01	3.09E+04	5.00E+04	0.01	1.00E+09	160.0000	1.60E+02	8.00E-05
ALDRIN		4.9E-03	0E+00	2.04E-04	2E-04		4.96E-04	3.65E+02	2.63E+02	5.00E+04	0.01	1.70E+01	0.0002	2.04E-04	8.00E-05
BENZENE	9.0E+00	8.3E-06	2E+00	1.20E-01	1E-01	2.10E+01	5.50E-03	7.80E+01	4.89E+03	5.00E+04	0.5	1.78E+06	0.1205	2.10E+01	8.00E-05
BENZO(a)PYRENE		1.7E-03	0E+00	5.88E-04	6E-04	0.00E+00	4.90E-07	2.52E+02		5.00E+04	0.05	3.80E+00	0.0006	5.88E-04	8.00E-05
BIS(2-CHLOROETHYL)ETHER		3.3E-04	0E+00	3.03E-03	3E-03		1.30E-05	1.43E+02	2.87E+02	5.00E+04	4.4	1.02E+07	0.0030	3.03E-03	8.00E-05
BIS(2-CHLOROISOPROPYL)ETHER		1.0E-05	0E+00	1.00E-01	1E-01		1.13E-04	1.71E+02	2.24E+03	5.00E+04	2.2	1.70E+06	0.1000	1.00E-01	8.00E-05
BIS(2-ETHYLHEXYL)PHTHALATE	7.0E+00	1.3E-06	1E+00	7.69E-01	8E-01	0.00E+00	3.00E-07	3.91E+02		5.00E+04	2.2	1.30E+03	0.7692	7.69E-01	8.00E-05
BROMOFORM		1.1E-06	0E+00	9.09E-01	9E-01		5.32E-04	2.53E+02	1.35E+04	5.00E+04	5	3.20E+06	0.9091	9.09E-01	8.00E-05
BROMOMETHANE	5.0E+00		1E+00	0.00E+00	1E+00		1.97E-01	9.50E+01	8.00E+04	5.00E+04	3.7	1.75E+07	1.0000	1.00E+00	8.00E-05
CARBON TETRACHLORIDE	4.3E+02	1.5E-05	9E+01	6.67E-02	7E-02	1.00E+00	2.93E-02	1.54E+02	6.30E+04	5.00E+04	2	8.00E+05	0.0667	1.00E+00	8.00E-05
CHLORDANE	7.0E-01	3.7E-04	1E-01	2.70E-03	3E-03		4.79E-05	4.10E+02	8.40E+00	5.00E+04	0.02	5.60E+01	0.0027	2.70E-03	8.00E-05
CHLOROBENZENE	2.0E+01		4E+00	0.00E+00	4E+00	1.00E+01	3.93E-03	1.13E+02	1.00E+03	5.00E+04	0.5	4.88E+05	4.0000	1.00E+01	8.00E-05
CHLOROFORM	6.6E+02	2.3E-05	1E+02	4.35E-02	4E-02	3.00E+00	3.39E-03	1.19E+02	4.22E+05	5.00E+04	1	9.30E+06	0.0435	3.00E+00	8.00E-05
DICHLOROBENZENE, 1,2- (o-DCB)	2.0E+02		4E+01	0.00E+00	4E+01	1	1.94E-03	1.47E+02	3.05E+05	5.00E+04	0.5	1.45E+05	40.0000	4.00E+01	8.00E-05
DICHLOROBENZENE, 1,3- (m-DCB)															
DICHLOROBENZENE, 1,4- (p-DCB)	8.0E+02		2E+02	0.00E+00	2E+02	0.5	2.72E-03	1.47E+02	1.10E+03	5.00E+04	0.5	7.90E+04	160.0000	1.60E+02	8.00E-05
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)		9.7E-05	0E+00	1.03E-02	1E-02		3.89E-05	3.54E+02		5.00E+04	0.05	3.10E+00	0.0103	1.03E-02	8.00E-05
DICHLOROETHANE, 1,1-	5.0E+02		1E+02	0.00E+00	1E+02	0.00E+00	5.45E-03	9.90E+01	1.25E+05	5.00E+04	0.5	5.50E+06	100.0000	1.00E+02	8.00E-05
DICHLOROETHANE, 1,2-	5.5E+01	2.6E-05	1E+01	3.85E-02	4E-02	0.00E+00	1.10E-03	9.90E+01	2.42E+03	5.00E+04	1	8.69E+06	0.0385	3.85E-02	8.00E-05
DICHLOROETHYLENE, 1,1-	6.0E+00	5.0E-05	1E+00	2.00E-02	2E-02	0.00E+00	1.49E-02	9.70E+01	1.25E+05	5.00E+04	0.5	2.10E+05	0.0200	2.00E-02	8.00E-05
DICHLOROPROPANE, 1,2-	4.0E+00	1.9E-05	8E-01	5.35E-02	5E-02		2.82E-03	1.13E+02	1.19E+03	5.00E+04	0.5	2.70E+06	0.0535	5.35E-02	8.00E-05
DICHLOROPROPENE, 1,3-	2.0E+01	3.7E-05	4E+00	2.70E-02	3E-02		3.50E-03	1.11E+02	4.61E+03	5.00E+04	1.4	2.70E+06	0.0270	2.70E-02	8.00E-05
DIELDRIN		4.6E-03	0E+00	2.17E-04	2E-04		5.84E-05	3.81E+02		5.00E+04	0.02	1.86E+02	0.0002	2.17E-04	8.00E-05
ETHYLBENZENE	1.0E+03		2E+02	0.00E+00	2E+02	1.00E+01	3.43E-03	1.06E+02	2.00E+03	5.00E+04	0.5	1.61E+05	200.0000	2.00E+02	8.00E-05
ETHYLENE DIBROMIDE	2.0E-01	2.2E-04	4E-02	4.55E-03	5E-03	0.00E+00	6.73E-04	1.88E+02	2.00E+05	5.00E+04	1	4.30E+06	0.0045	4.55E-03	8.00E-05
HEPTACHLOR	7.0E-01	1.3E-03	1E-01	7.69E-04	8E-04		1.48E-03	3.74E+02	3.00E+02	5.00E+04	0.01	5.60E+01	0.0008	7.69E-04	8.00E-05
HEPTACHLOR EPOXIDE		2.6E-03	0E+00	3.85E-04	4E-04		3.16E-05	3.89E+02	3.00E+02	5.00E+04	0.01	3.50E+02	0.0004	3.85E-04	8.00E-05
HEXACHLOROBENZENE		4.6E-04	0E+00	2.17E-03	2E-03		1.70E-03	2.85E+02		5.00E+04	0.01	1.10E+02	0.0022	2.17E-03	8.00E-05
HEXACHLOROBUTADIENE		2.2E-05	0E+00	4.55E-02	5E-02		2.56E-02	2.61E+02	1.20E+04	5.00E+04	0.01	2.00E+03	0.0455	4.55E-02	8.00E-05
HEXACHLOROETHANE	3.0E+00	4.0E-06	6E-01	2.50E-01	3E-01		9.85E-03	2.37E+02		5.00E+04	0.01	5.00E+04	0.2500	2.50E-01	8.00E-05
METHYL ETHYL KETONE	1.0E+03		2E+02	0.00E+00	2E+02	4.20E+01	5.77E-05	7.20E+01	3.20E+04	5.00E+04	100	2.75E+08	200.0000	2.00E+02	8.00E-05
METHYL ISOBUTYL KETONE	8.0E+01		2E+01	0.00E+00	2E+01	2.00E+00	1.38E-04	1.00E+02	9.70E+03	5.00E+04	50	1.91E+07	16.0000	1.60E+01	8.00E-05
METHYL TERT BUTYL ETHER	5.0E+02		1E+02	0.00E+00	1E+02	0.00E+00	5.91E-04	8.80E+01		5.00E+04	0.5	4.80E+07	100.0000	1.00E+02	8.00E-05
METHYLENE CHLORIDE	3.0E+03	4.7E-07	6E+02	2.13E+00	2E+00	6.00E+02	3.19E-03	8.50E+01	5.40E+05	5.00E+04	5	1.67E+07	2.1277	6.00E+02	8.00E-05
METHYLNAPHTHALENE, 2-	7.1E+01		1E+01	0.00E+00	1E+01	0.00E+00	2.90E-04	1.42E+02	6.80E+01	5.00E+04	2.2	2.60E+04	14.2000	1.42E+01	8.00E-05
NAPHTHALENE	7.1E+01		1E+01	0.00E+00	1E+01	5.00E+00	1.18E-03	1.28E+02	4.40E+02	5.00E+04	1.6	3.10E+04	14.2000	1.42E+01	8.00E-05
PENTACHLOROPHENOL	7.0E-02		1E-02	0.00E+00	1E-02		2.80E-06	2.66E+02		5.00E+04	0.1	1.40E+04	0.0140	1.40E-02	8.00E-05
PHENOL	2.6E+02		5E+01	0.00E+00	5E+01	0.00E+00	1.30E-06	9.40E+01	1.57E+02	5.00E+04	2.4	8.00E+07	52.0000	5.20E+01	8.00E-05
POLYCHLORINATED BIPHEYLS	2.0E-02		4E-03	0.00E+00	4E-03	0.00E+00	2.00E-03	varies		5.00E+04	0.2	3.10E+01	0.0040	4.00E-03	8.00E-05
STYRENE	1.0E+03	5.7E-07	2E+02	1.75E+00	2E+00	5.00E+00	2.61E-03	1.04E+02	1.36E+03	5.00E+04	0.5	3.00E+05	1.7544	5.00E+00	8.00E-05
TETRACHLOROETHANE, 1,1,1,2-		7.4E-06	0E+00	1.35E-01	1E-01		1.10E-02	1.68E+02		5.00E+04	5	2.00E+05	0.1351	1.35E-01	8.00E-05
TETRACHLOROETHANE, 1,1,2,2-	9.3E+01	5.8E-05	2E+01	1.72E-02	2E-02	0.01	3.80E-04	1.68E+02	1.05E+04	5.00E+04	1	2.90E+06	0.0172	1.72E-02	8.00E-05
TETRACHLOROETHYLENE	4.6E+03	5.2E-07	9E+02	1.92E+00	2E+00	1.10E+01	2.04E-03	1.66E+02	3.17E+04	5.00E+04	0.5	2.00E+05	1.9231	1.10E+01	8.00E-05
TOLUENE	4.0E+02		8E+01	0.00E+00	8E+01	2.90E+01	6.68E-03	9.20E+01	3.00E+04	5.00E+04	0.5	5.35E+05	80.0000	8.00E+01	8.00E-05
TRICHLOROBENZENE, 1,2,4-	9.0E+00		2E+00	0.00E+00	2E+00	0.04	1.42E-03	1.81E+02	2.20E+04	5.00E+04	0.05	1.90E+04	1.8000	1.80E+00	8.00E-05
TRICHLOROETHANE, 1,1,1-	1.0E+03		2E+02	0.00E+00	2E+02	3.00E+01	2.31E-02	1.33E+02	6.51E+04	5.00E+04	0.5	7.30E+05	200.0000	2.00E+02	8.00E-05
TRICHLOROETHANE, 1,1,2-	7.4E+01	1.6E-05	1E+01	6.25E-02	6E-02	3.00E+01	9.10E-04	1.33E+02		5.00E+04	0.6	4.50E+06	0.0625	3.00E+01	8.00E-05
TRICHLOROETHYLENE	1.8E+02	1.7E-06	4E+01	5.88E-01	6E-01	5.00E+00	9.12E-03	1.31E+02	1.36E+06	5.00E+04	0.5	1.10E+06	0.5882	5.00E+00	8.00E-05
TRICHLOROPHENOL 2,4,6-		3.1E-06	0E+00	3.23E-01	3E-01		4.00E-06	1.97E+02	3.00E-01	5.00E+04	0.2	8.00E+05	0.3000	3.00E-01	8.00E-05
VINYL CHLORIDE	1.7E+01	8.4E-05	3E+00	1.19E-02	1E-02	0.00E+00	2.78E-02	6.30E+01	7.71E+05	5.00E+04	0.5	1.10E+03	0.0119	1.19E-02	8.00E-05
XYLENES	3.0E+02		6E+01	0.00E+00	6E+01	3	5.27E-03	1.06E+02	4.41E+02	5.00E+04	1.1	1.71E+05	60.0000	6.00E+01	8.00E-05

GROUNDWATER (GW-2)					GW-2 INT		GROUNDWATER	GROUNDWATER	
FOR MEDIUM/FINE TEXTURED SOIL SITUATION					HIGHEST	LOWEST	GW-2	GW-2	
	SOURCE	HENRY'S	UNITS	VOLATILITY	VOL VALUE,	GW-2 INT,	PROPOSED	PROPOSED	
	DILUTION	LAW	CONVERSION	BASED	MDL/PQL,	CEILING,	STANDARD	STANDARD	
	FACTOR	CONSTANT		VALUE	BCKGRND	1/2 SOL.	(raw value)	(Rounded)	BASIS
CHEMICAL PARAMETER	(d)	conc/conc	l/cu m	µg/L	µg/L	µg/L	ug/L	ug/L	
ACETONE	1.00E-01	2E-03	1000	11472300	11472300	5.00E+04	5.00E+04	50000.00	Ceiling
ALDRIN	1.00E-01	2E-02	1000	1	1	1.26E+00	1.26E+00	1.30	Risk
BENZENE	1.00E-01	2E-01	1000	11663	11663	1.17E+04	1.17E+04	12000.00	Bckgrnd-Air
BENZO(a)PYRENE	1.00E-01	2E-05	1000	3667	3667	1.90E+00	1.90E+00	1.90	Solubility
BIS(2-CHLOROETHYL)ETHER	1.00E-01	5E-04	1000	712	712	7.12E+02	7.12E+02	710.00	Risk
BIS(2-CHLOROISOPROPYL)ETHER	1.00E-01	5E-03	1000	2703	2703	2.70E+03	2.70E+03	2700.00	Risk
BIS(2-ETHYLHEXYL)PHTHALATE	1.00E-01	1E-05	1000	7832051	7832051	6.50E+02	6.50E+02	650.00	Solubility
BROMOFORM	1.00E-01	2E-02	1000	5220	5220	5.22E+03	5.22E+03	5200.00	Risk
BROMOMETHANE	1.00E-01	8E+00	1000	16	16	1.55E+01	1.55E+01	16.00	Risk
CARBON TETRACHLORIDE	1.00E-01	1E+00	1000	104	104	1.04E+02	1.04E+02	100.00	Bckgrnd-Air
CHLORDANE	1.00E-01	2E-03	1000	172	172	2.80E+01	2.80E+01	28.00	Solubility
CHLOROBENZENE	1.00E-01	2E-01	1000	7772	7772	7.77E+03	7.77E+03	7800.00	Bckgrnd-Air
CHLOROFORM	1.00E-01	1E-01	1000	2703	2703	2.70E+03	2.70E+03	2700.00	Bckgrnd-Air
DICHLOROBENZENE, 1,2- (o-DCB)	1.00E-01	8E-02	1000	62979	62979	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROBENZENE, 1,3- (m-DCB)								50000.00	Ceiling
DICHLOROBENZENE, 1,4- (p-DCB)	1.00E-01	1E-01	1000	179676	179676	3.95E+04	3.95E+04	40000.00	Solubility
DICHLORODIPHENYLTRICHLOROETHANE, P,P'- (DDT)	1.00E-01	2E-03	1000	810	810	1.55E+00	1.55E+00	1.55	Solubility
DICHLOROETHANE, 1,1-	1.00E-01	2E-01	1000	56046	56046	5.00E+04	5.00E+04	50000.00	Ceiling
DICHLOROETHANE, 1,2-	1.00E-01	5E-02	1000	107	107	1.07E+02	1.07E+02	110.00	Risk
DICHLOROETHYLENE, 1,1-	1.00E-01	6E-01	1000	4	4	4.10E+00	4.10E+00	4.10	Risk
DICHLOROPROPANE, 1,2-	1.00E-01	1E-01	1000	58	58	5.79E+01	5.79E+01	58.00	Risk
DICHLOROPROPENE, 1,3-	1.00E-01	1E-01	1000	24	24	2.36E+01	2.36E+01	24.00	Risk
DIELDRIN	1.00E-01	2E-03	1000	11	11	1.14E+01	1.14E+01	11.00	Risk
ETHYLBENZENE	1.00E-01	1E-01	1000	178105	178105	5.00E+04	5.00E+04	50000.00	Ceiling
ETHYLENE DIBROMIDE	1.00E-01	3E-02	1000	21	21	2.06E+01	2.06E+01	21.00	Risk
HEPTACHLOR	1.00E-01	6E-02	1000	2	2	1.59E+00	1.59E+00	1.60	Risk
HEPTACHLOR EPOXIDE	1.00E-01	1E-03	1000	37	37	3.72E+01	3.72E+01	37.00	Risk
HEXACHLOROBENZENE	1.00E-01	7E-02	1000	4	4	3.91E+00	3.91E+00	3.90	Risk
HEXACHLOROBUTADIENE	1.00E-01	1E+00	1000	5	5	5.42E+00	5.42E+00	5.40	Risk
HEXACHLOROETHANE	1.00E-01	4E-01	1000	78	78	7.75E+01	7.75E+01	78.00	Risk
METHYL ETHYL KETONE	1.00E-01	2E-03	1000	10587522	10587522	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL ISOBUTYL KETONE	1.00E-01	6E-03	1000	354145	354145	5.00E+04	5.00E+04	50000.00	Ceiling
METHYL TERT BUTYL ETHER	1.00E-01	2E-02	1000	516836	516836	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLENE CHLORIDE	1.00E-01	1E-01	1000	574514	574514	5.00E+04	5.00E+04	50000.00	Ceiling
METHYLNAPHTHALENE, 2-	1.00E-01	1E-02	1000	149565	149565	1.30E+04	1.30E+04	13000.00	Solubility
NAPHTHALENE	1.00E-01	5E-02	1000	36758	36758	1.55E+04	1.55E+04	16000.00	Solubility
PENTACHLOROPHENOL	1.00E-01	1E-04	1000	15273	15273	7.00E+03	7.00E+03	7000.00	Solubility
PHENOL	1.00E-01	5E-05	1000	122180000	122180000	5.00E+04	5.00E+04	50000.00	Ceiling
POLYCHLORINATED BIPHEYLS	1.00E-01	8E-02	1000	6	6	6.11E+00	6.11E+00	6.10	Risk
STYRENE	1.00E-01	1E-01	1000	5852	5852	5.85E+03	5.85E+03	5900.00	Bckgrnd-Air
TETRACHLOROETHANE, 1,1,1,2-	1.00E-01	5E-01	1000	38	38	3.75E+01	3.75E+01	38.00	Risk
TETRACHLOROETHANE, 1,1,2,2-	1.00E-01	2E-02	1000	139	139	1.39E+02	1.39E+02	140.00	Risk
TETRACHLOROETHYLENE	1.00E-01	8E-02	1000	16470	16470	1.65E+04	1.65E+04	17000.00	Bckgrnd-Air
TOLUENE	1.00E-01	3E-01	1000	36581	36581	3.66E+04	3.66E+04	37000.00	Risk
TRICHLOROBENZENE, 1,2,4-	1.00E-01	6E-02	1000	3872	3872	3.87E+03	3.87E+03	3900.00	Risk
TRICHLOROETHANE, 1,1,1-	1.00E-01	9E-01	1000	26446	26446	2.64E+04	2.64E+04	26000.00	Risk
TRICHLOROETHANE, 1,1,2-	1.00E-01	4E-02	1000	100698	100698	5.00E+04	5.00E+04	50000.00	Ceiling
TRICHLOROETHYLENE	1.00E-01	4E-01	1000	1675	1675	1.67E+03	1.67E+03	1700.00	Bckgrnd-Air
TRICHLOROPHENOL 2,4,6-	1.00E-01	2E-04	1000	229088	229088	5.00E+04	5.00E+04	50000.00	Ceiling
VINYL CHLORIDE	1.00E-01	1E+00	1000	1	1	1.31E+00	1.31E+00	1.30	Risk
XYLENES	1.00E-01	2E-01	1000	34776	34776	3.48E+04	3.48E+04	35000.00	Risk

Appendix B.1.9: Derivation of Soil-to-Indoor Air Concentrations. (Coarse Textured Soils).

SOIL TO INDOOR AIR

COARSE TEXTURED SOILS

CHEMICAL PARAMETER	Koc ml/g	HENRY'S LAW CONSTANT atm-m3/mol	LOWEST RISK Odour (Air) ug/cu m	INDOOR AIR BACKGROUND (vapours) ug/cu m	HIGHER Background (Risk, odour) ug/cu m	Csp ug/g	Csg ug/cu m	Csw ug/L	Csp ug/cu cm	Csg ug/cu cm	Csw ug/cu cm	Total C (d.w.) ug/gm	Total C degrade. adj. ug/gm
ACENAPHTHENE	4.60E+03												
ACENAPHTHYLENE	2.50E+03												
ACETONE	5.37E+00	4.26E-05	1.60E+02	6.06E+00	1.60E+02	4.84E+00	1.60E+06	9.01E+05	7.70E+00	4.80E-01	9.01E+01	6.14E+01	1.90E+03
ALDRIN	4.90E+04	4.96E-04	2.04E-04		2.04E-04	4.84E-03	2.04E+00	9.87E-02	7.69E-03	6.12E-07	9.87E-06	4.81E-03	1.49E-01
ANTHRACENE	1.40E+04												
BENZENE	8.30E+01	5.50E-03	1.20E-01	2.10E+01	2.10E+01	7.61E-02	2.10E+05	9.16E+02	1.21E-01	6.30E-02	9.16E-02	1.72E-01	5.34E+00
BENZO(a)ANTHRACENE	2.00E+05												
BENZO(a)PYRENE	5.50E+06	4.90E-07	5.88E-04	0.00E+00	5.88E-04	1.58E+03	5.88E+00	2.88E+02	2.52E+03	1.76E-06	2.88E-02	1.57E+03	4.88E+04
BENZO(b)FLUORANTHENE	5.50E+05												
BENZO(g,h,i)PERYLENE	1.60E+06												
BENZO(k)FLUORANTHENE	5.50E+05												
BIS(2-CHLOROETHYL)ETHER	1.26E+01	1.30E-05	3.03E-03		3.03E-03	7.04E-04	3.03E+01	5.59E+01	1.12E-03	9.09E-06	5.59E-03	4.20E-03	1.30E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.00E-01		1.00E-01	1.30E-02	1.00E+03	2.12E+02	2.06E-02	3.00E-04	2.12E-02	2.63E-02	8.16E-01
BIS(2-ETHYLHEXYL)PHTHALATE	1.00E+05	3.00E-07	7.69E-01	0.00E+00	7.69E-01	6.15E+04	7.69E+03	6.15E+05	9.78E+04	2.31E-03	6.15E+01	6.12E+04	1.90E+06
BROMODICHLOROMETHANE	6.31E+01												
BROMOFORM	1.15E+02	5.32E-04	9.09E-01		9.09E-01	4.71E-02	9.09E+03	4.10E+02	7.49E-02	2.73E-03	4.10E-02	7.41E-02	2.30E+00
BROMOMETHANE	5.89E+00	1.97E-01	1.00E+00		1.00E+00	7.17E-06	1.00E+04	1.22E+00	1.14E-05	3.00E-03	1.22E-04	1.96E-03	6.07E-02
CARBON TETRACHLORIDE	1.10E+02	2.93E-02	6.67E-02	1.00E+00	1.00E+00	8.98E-04	1.00E+04	8.19E+00	1.43E-03	3.00E-03	8.19E-04	3.28E-03	1.02E-01
CHLORDANE	4.37E+04	4.79E-05	2.70E-03		2.70E-03	5.91E-01	2.70E+01	1.35E+01	9.40E-01	8.11E-06	1.35E-03	5.88E-01	1.82E+01
CHLOROANILINE, p-	6.40E+01												
CHLOROBENZENE	3.31E+02	3.93E-03	4.00E+00	1.00E+01	1.00E+01	2.02E-01	1.00E+05	6.11E+02	3.22E-01	3.00E-02	6.11E-02	2.58E-01	7.99E+00
CHLOROFORM	3.10E+01	3.39E-03	4.35E-02	3.00E+00	3.00E+00	6.58E-03	3.00E+04	2.12E+02	1.05E-02	9.00E-03	2.12E-02	2.54E-02	7.89E-01
CHLOROPHENOL, 2-	1.10E+02												
CHRYSENE	2.00E+05												
CYANIDE	9.20E+00												
DIBENZO(a,h)ANTHRACENE	3.30E+06												
DIBROMOCHLOROMETHANE	8.32E+01												
DICHLOROBENZENE, 1,2- (o-DCB)	1.70E+03	1.94E-03	4.00E+01	1.12E+00	4.00E+01	8.41E+00	4.00E+05	4.95E+03	1.34E+01	1.20E-01	4.95E-01	8.74E+00	2.71E+02
DICHLOROBENZENE, 1,3- (m-DCB)	1.70E+03												
DICHLOROBENZENE, 1,4- (p-DCB)	1.82E+03	2.72E-03	1.60E+02	4.96E-01	1.60E+02	2.57E+01	1.60E+06	1.41E+04	4.08E+01	4.80E-01	1.41E+00	2.67E+01	8.28E+02
DICHLOROBENZIDINE, 3,3'-	1.55E+03												
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	7.76E+05												
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	4.37E+06												
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	2.40E+05	3.89E-05	1.03E-02		1.03E-02	1.53E+01	1.03E+02	6.36E+01	2.43E+01	3.09E-05	6.36E-03	1.52E+01	4.70E+02
DICHLOROETHANE, 1,1-	5.75E+01	5.45E-03	1.00E+02	0.00E+00	1.00E+02	2.53E-01	1.00E+06	4.40E+03	4.03E-01	3.00E-01	4.40E-01	7.15E-01	2.22E+01
DICHLOROETHANE, 1,2-	1.38E+01	1.10E-03	3.85E-02	0.00E+00	3.85E-02	1.16E-04	3.85E+02	8.39E+00	1.84E-04	1.15E-04	8.39E-04	7.12E-04	2.21E-02
DICHLOROETHYLENE, 1,1-	6.46E+01	1.49E-02	2.00E-02	0.00E+00	2.00E-02	2.08E-05	2.00E+02	3.22E-01	3.31E-05	6.00E-05	3.22E-05	7.83E-05	2.43E-03
DICHLOROETHYLENE, CIS-1,2-	4.90E+01												
DICHLOROETHYLENE, TRANS-1,2-	4.90E+01												
DICHLOROPHENOL, 2,4-	6.03E+03												
DICHLOROPROPANE, 1,2-	4.68E+01	2.82E-03	5.35E-02		5.35E-02	2.13E-04	5.35E+02	4.55E+00	3.38E-04	1.60E-04	4.55E-04	5.96E-04	1.85E-02
DICHLOROPROPENE, 1,3-	2.57E+01	3.50E-03	2.70E-02		2.70E-02	4.76E-05	2.70E+02	1.85E+00	7.57E-05	8.11E-05	1.85E-04	2.14E-04	6.63E-03
DIELDRIN	7.41E+03	5.84E-05	2.17E-04		2.17E-04	6.62E-03	2.17E+00	8.93E-01	1.05E-02	6.52E-07	8.93E-05	6.64E-03	2.06E-01
DIETHYL PHTHALATE	1.42E+02												
DIMETHYL PHTHALATE	1.42E+02												

SOIL TO INDOOR AIR

COARSE TEXTURED SOILS CHEMICAL PARAMETER	Koc ml/g	HENRY'S LAW CONSTANT atm-m3/mol	LOWEST RISK Odour (Air) ug/cu m	INDOOR AIR BACKGROUND (vapours) ug/cu m	HIGHER Background (Risk, odour) ug/cu m	Csp ug/g	Csg ug/cu m	Csw ug/L	Csp ug/cu cm	Csg ug/cu cm	Csw ug/cu cm	Total C (d.w.) ug/gm	Total C degrade. adj. ug/gm
DIMETHYLPHENOL, 2,4-	4.00E+01												
DINITROPHENOL, 2,4-	1.66E+01												
DINITROTOLUENE, 2,4-	4.47E+01												
ENDOSULFAN	3.16E+03												
ENDRIN	1.70E+03												
ETHYLBENZENE	5.75E+02	3.43E-03	2 00E+02	1.00E+01	2.00E+02	8.05E+00	2.00E+06	1.40E+04	1.28E+01	6.00E-01	1.40E+00	9.25E+00	2.87E+02
ETHYLENE DIBROMIDE	4.40E+01	6.73E-04	4.55E-03	0.00E+00	4.55E-03	7.13E-05	4.55E+01	1.62E+00	1.13E-04	1.36E-05	1.62E-04	1.81E-04	5.60E-03
FLUORANTHENE	3 80E+04												
FLUORENE	7.30E+03												
HEPTACHLOR	2.19E+04	1.48E-03	7.69E-04		7.69E-04	2.73E-03	7.69E+00	1.25E-01	4.34E-03	2.31E-06	1.25E-05	2.72E-03	8.44E-02
HEPTACHLOR EPOXIDE	2.34E+04	3.16E-05	3.85E-04		3.85E-04	6.85E-02	3.85E+00	2.92E+00	1.09E-01	1.15E-06	2.92E-04	6.82E-02	2.12E+00
HEXACHLOROBENZENE	1.20E+06	1.70E-03	2.17E-03		2.17E-03	3.69E-01	2.17E+01	3.07E-01	5.87E-01	6.52E-06	3.07E-05	3.67E-01	1.14E+01
HEXACHLOROBUTADIENE	2.90E+04	2.56E-02	4.55E-02		4.55E-02	1.24E-02	4.55E+02	4.26E-01	1.96E-02	1.36E-04	4.26E-05	1.24E-02	3.84E-01
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.72E+03												
HEXACHLOROETHANE	2.00E+04	9.85E-03	2.50E-01		2.50E-01	1.22E-01	2.50E+03	6.09E+00	1.94E-01	7.50E-04	6.09E-04	1.22E-01	3.78E+00
INDENO(1,2,3-cd)PYRENE	1.60E+06												
METHOXYCHLOR	7.94E+04												
METHYL ETHYL KETONE	3.55E+00	5.77E-05	2.00E+02	4.20E+01	2.00E+02	2.95E+00	2.00E+06	8.32E+05	4.69E+00	6.00E-01	8.32E+01	5.53E+01	1.71E+03
METHYL ISOBUTYL KETONE	3.09E+00	1.38E-04	1.60E+01	2.00E+00	1.60E+01	8.60E-02	1.60E+05	2.78E+04	1.37E-01	4.80E-02	2.78E+00	1.85E+00	5.75E+01
METHYL TERT BUTYL ETHER	2.70E+01	5.91E-04	1.00E+02	0.00E+00	1.00E+02	1.10E+00	1.00E+06	4.06E+04	1.74E+00	3 00E-01	4.06E+00	3.82E+00	1.18E+02
METHYLENE CHLORIDE	8 80E+00	3.19E-03	2.13E+00	6.00E+02	6.00E+02	3.97E-01	6.00E+06	4.51E+04	6.32E-01	1.80E+00	4.51E+00	4.34E+00	1.35E+02
METHYLNAPHTHALENE, 2-	7.20E+02	2.90E-04	1.42E+01	0.00E+00	1.42E+01	8.46E+00	1.42E+05	1.18E+04	1.35E+01	4.26E-02	1.18E+00	9.17E+00	2.84E+02
NAPHTHALENE	1.29E+03	1.18E-03	1.42E+01	5.00E+00	1.42E+01	3.72E+00	1.42E+05	2.89E+03	5.91E+00	4.26E-02	2.89E-01	3.90E+00	1.21E+02
PENTACHLOROPHENOL	3.16E+04	2.80E-06	1.40E-02		1.40E-02	3.79E+01	1.40E+02	1.20E+03	6.03E+01	4.20E-05	1.20E-01	3.78E+01	1.17E+03
PHENANTHRENE	1.40E+04												
PHENOL	9.12E+01	1.30E-06	5.20E+01	0.00E+00	5.20E+01	8.76E+02	5.20E+05	9.60E+06	1.39E+03	1.56E-01	9.60E+02	1.47E+03	4.56E+04
PYRENE	3.80E+04												
STYRENE	3.09E+00	2.61E-03	1.75E+00	5.00E+00	5.00E+00	1.42E-03	5.00E+04	4.60E+02	2.26E-03	1.50E-02	4.60E-02	3.95E-02	1.23E+00
TETRACHLOROETHANE, 1,1,1,2-	5.40E+01	1.10E-02	1.35E-01		1.35E-01	1.59E-04	1.35E+03	2.95E+00	2.53E-04	4.05E-04	2.95E-04	5 96E-04	1.85E-02
TETRACHLOROETHANE, 1,1,2,2-	4.57E+01	3.80E-04	1.72E-02	7.44E-03	1.72E-02	4.98E-04	1.72E+02	1.09E+01	7.91E-04	5.17E-05	1.09E-03	1.21E-03	3.74E-02
TETRACHLOROETHYLENE	4.68E+02	2.04E-03	1.92E+00	1.10E+01	1.10E+01	6.06E-01	1.10E+05	1.29E+03	9.63E-01	3.30E-02	1.29E-01	7.03E-01	2.18E+01
THALLIUM													
TOLUENE	2.70E+02	6.68E-03	8.00E+01	2.90E+01	8.00E+01	7.76E-01	8.00E+05	2.87E+03	1.23E+00	2.40E-01	2.87E-01	1.10E+00	3.41E+01
TRICHLOROBENZENE, 1,2,4-	9.20E+03	1.42E-03	1.80E+00	3.60E-02	1.80E+00	2.80E+00	1.80E+04	3.04E+02	4.45E+00	5.40E-03	3.04E-02	2.80E+00	8.69E+01
TRICHLOROETHANE, 1,1,1-	1.57E+02	2.31E-02	2.00E+02	3.00E+01	2.00E+02	3.26E-01	2.00E+06	2.08E+03	5.19E-01	6.00E-01	2.08E-01	8.29E-01	2.57E+01
TRICHLOROETHANE, 1,1,2-	3.09E+02	9.10E-04	6.25E-02	3.00E+01	3.00E+01	2.45E+00	3.00E+05	7.91E+03	3.89E+00	9.00E-02	7.91E-01	2.98E+00	9.24E+01
TRICHLOROETHYLENE	1.24E+02	9.12E-03	5.88E-01	5.00E+00	5.00E+00	1.63E-02	5.00E+04	1.32E+02	2.59E-02	1.50E-02	1.32E-02	3.38E-02	1.05E+00
TRICHLOROPHENOL, 2,4,5-	8.90E+01												
TRICHLOROPHENOL 2,4,6-	2.00E+03	4.00E-06	3.00E-01		3.00E-01	3.60E+01	3.00E+03	1.80E+04	5.72E+01	9.00E-04	1.80E+00	3.69E+01	1.14E+03
VINYL CHLORIDE	9.77E+01	2.78E-02	1.19E-02	0.00E+00	1.19E-02	1.00E-05	1.19E+02	1.03E-01	1.60E-05	3.57E-05	1.03E-05	3.87E-05	1.20E-03
XYLENES	3.02E+02	5.27E-03	6.00E+01	3.06E+00	6.00E+01	8.25E-01	6.00E+05	2.73E+03	1.31E+00	1.80E-01	2.73E-01	1.10E+00	3.42E+01

Assumption: Soil Particle Volume = 60%, Soil Gas Volume = 30%, Soil Water Volume = 10%

Particle Density = 2 65 gm/cu cm, Bulk Density = 1.6 gm/cu cm

Degradation adjustment factor = 31, Foc = 0.001

Appendix B.1.10: Derivation of Soil-to-Indoor Air Concentrations. (Medium/Fine Textured Soils).

SOIL TO INDOOR AIR

MEDIUM/FINE TEXTURED SOILS	Koc	HENRY'S LAW CONSTANT	LOWEST RISK Odour (Air)	INDOOR AIR BACKGROUND (vapours)	HIGHER Background (Risk, odour)	Csp	Csg	Csw	Csp	Csg	Csw	Total C (d.w.)	Total C degrade. adj.
CHEMICAL PARAMETER	ml/g	atm-m3/mol	ug/cu m	ug/cu m	ug/cu m	ug/g	ug/cu m	ug/L	ug/cu cm	ug/cu cm	ug/cu cm	ug/gm	ug/gm
ACENAPHTHENE	4.60E+03												
ACENAPHTHYLENE	2.50E+03												
ACETONE	5.37E+00	4.26E-05	1.60E+02	6.06E+00	1.60E+02	3.03E+01	1.00E+07	5.63E+06	4.81E+01	3.00E+00	5.63E+02	3.84E+02	1.19E+04
ALDRIN	4.90E+04	4.96E-04	2.04E-04		2.04E-04	3.02E-02	1.28E+01	6.17E-01	4.81E-02	3.83E-06	6.17E-05	3.01E-02	9.32E-01
ANTHRACENE	1.40E+04												
BENZENE	8.30E+01	5.50E-03	1.20E-01	2.10E+01	2.10E+01	4.75E-01	1.31E+06	5.73E+03	7.56E-01	3.94E-01	5.73E-01	1.08E+00	3.34E+01
BENZO(a)ANTHRACENE	2.00E+05					#DIV/0!	0.00E+00						
BENZO(a)PYRENE	5.50E+06	4.90E-07	5.88E-04	0.00E+00	5.88E-04	9.90E+03	3.68E+01	1.80E+03	1.57E+04	1.10E-05	1.80E-01	9.84E+03	3.05E+05
BENZO(b)FLUORANTHENE	5.50E+05												
BENZO(g,h,i)PERYLENE	1.60E+06												
BENZO(k)FLUORANTHENE	5.50E+05												
BIS(2-CHLOROETHYL)ETHER	1.26E+01	1.30E-05	3.03E-03		3.03E-03	4.40E-03	1.89E+02	3.50E+02	7.00E-03	5.68E-05	3.50E-02	2.63E-02	8.14E-01
BIS(2-CHLOROISOPROPYL)ETHER	6.10E+01	1.13E-04	1.00E-01		1.00E-01	8.10E-02	6.25E+03	1.33E+03	1.29E-01	1.88E-03	1.33E-01	1.65E-01	5.10E+00
BIS(2-ETHYLHEXYL)PHTHALATE	1.00E+05	3.00E-07	7.69E-01	0.00E+00	7.69E-01	3.85E+05	4.81E+04	3.85E+06	6.12E+05	1.44E-02	3.85E+02	3.82E+05	1.19E+07
BROMODICHLOROMETHANE	6.31E+01												
BROMOFORM	1.15E+02	5.32E-04	9.09E-01		9.09E-01	2.94E-01	5.68E+04	2.56E+03	4.68E-01	1.70E-02	2.56E-01	4.63E-01	1.44E+01
BROMOMETHANE	5.89E+00	1.97E-01	1.00E+00		1.00E+00	4.48E-05	6.25E+04	7.61E+00	7.13E-05	1.88E-02	7.61E-04	1.22E-02	3.79E-01
CARBON TETRACHLORIDE	1.10E+02	2.93E-02	6.67E-02	1.00E+00	1.00E+00	5.61E-03	6.25E+04	5.12E+01	8.93E-03	1.88E-02	5.12E-03	2.05E-02	6.35E-01
CHLORDANE	4.37E+04	4.79E-05	2.70E-03		2.70E-03	3.69E+00	1.69E+02	8.46E+01	5.87E+00	5.07E-05	8.46E-03	3.68E+00	1.14E+02
CHLOROANILINE, p-	6.40E+01												
CHLOROBENZENE	3.31E+02	3.93E-03	4.00E+00	1.00E+01	1.00E+01	1.26E+00	6.25E+05	3.82E+03	2.01E+00	1.88E-01	3.82E-01	1.61E+00	5.00E+01
CHLOROFORM	3.10E+01	3.39E-03	4.35E-02	3.00E+00	3.00E+00	4.12E-02	1.88E+05	1.33E+03	6.54E-02	5.63E-02	1.33E-01	1.59E-01	4.93E+00
CHLOROPHENOL, 2-	1.10E+02												
CHRYSENE	2.00E+05												
CYANIDE	9.20E+00												
DIBENZO(a,h)ANTHRACENE	3.30E+06												
DIBROMOCHLOROMETHANE	8.32E+01												
DICHLOROBENZENE, 1,2- (o-DCB)	1.70E+03	1.94E-03	4.00E+01	1.12E+00	4.00E+01	5.26E+01	2.50E+06	3.09E+04	8.36E+01	7.50E-01	3.09E+00	5.47E+01	1.69E+03
DICHLOROBENZENE, 1,3- (m-DCB)	1.70E+03												
DICHLOROBENZENE, 1,4- (p-DCB)	1.82E+03	2.72E-03	1.60E+02	4.96E-01	1.60E+02	1.61E+02	1.00E+07	8.82E+04	2.55E+02	3.00E+00	8.82E+00	1.67E+02	5.18E+03
DICHLOROBENZIDINE, 3,3'-	1.55E+03												
DICHLORODIPHENYL DICHLOROETHANE, P,P'-(DDD)	7.76E+05												
DICHLORODIPHENYLDICHLOROETHYLENE,P,P'-(DDE)	4.37E+06												
DICHLORODIPHENYLTRICHLOROETHANE, P,P'-(DDT)	2.40E+05	3.89E-05	1.03E-02		1.03E-02	9.54E+01	6.44E+02	3.98E+02	1.52E+02	1.93E-04	3.98E-02	9.48E+01	2.94E+03
DICHLOROETHANE, 1,1-	5.75E+01	5.45E-03	1.00E+02	0.00E+00	1.00E+02	1.58E+00	6.25E+06	2.75E+04	2.52E+00	1.88E+00	2.75E+00	4.47E+00	1.38E+02
DICHLOROETHANE, 1,2-	1.38E+01	1.10E-03	3.85E-02	0.00E+00	3.85E-02	7.24E-04	2.40E+03	5.24E+01	1.15E-03	7.21E-04	5.24E-03	4.45E-03	1.38E-01
DICHLOROETHYLENE, 1,1-	6.46E+01	1.49E-02	2.00E-02	0.00E+00	2.00E-02	1.30E-04	1.25E+03	2.01E+00	2.07E-04	3.75E-04	2.01E-04	4.89E-04	1.52E-02
DICHLOROETHYLENE, CIS-1,2-	4.90E+01												
DICHLOROETHYLENE, TRANS-1,2-	4.90E+01												
DICHLOROPHENOL, 2,4-	6.03E+03												
DICHLOROPROPANE, 1,2-	4.68E+01	2.82E-03	5.35E-02		5.35E-02	1.33E-03	3.34E+03	2.84E+01	2.12E-03	1.00E-03	2.84E-03	3.73E-03	1.16E-01
DICHLOROPROPENE, 1,3-	2.57E+01	3.50E-03	2.70E-02		2.70E-02	2.98E-04	1.69E+03	1.16E+01	4.73E-04	5.07E-04	1.16E-03	1.34E-03	4.14E-02
DIELDRIN	7.41E+03	5.84E-05	2.17E-04		2.17E-04	4.14E-02	1.36E+01	5.58E+00	6.58E-02	4.08E-06	5.58E-04	4.15E-02	1.29E+00
DIETHYL PHTHALATE	1.42E+02												
DIMETHYL PHTHALATE	1.42E+02												

SOIL TO INDOOR AIR

MEDIUM/FINE TEXTURED SOILS		HENRY'S	LOWEST	INDOOR AIR	HIGHER								
		LAW	RISK	BACKGROUND	Background							Total C	Total C
	Koc	CONSTANT	Odour (Air)	(vapours)	(Risk, odour)	Csp	Csg	Csw	Csp	Csg	Csw	(d.w.)	degrade. adj.
CHEMICAL PARAMETER	ml/g	atm-m3/mol	ug/cu m	ug/cu m	ug/cu m	ug/g	ug/cu m	ug/L	ug/cu cm	ug/cu cm	ug/cu cm	ug/gm	ug/gm
DIMETHYLPHENOL, 2,4-	4.00E+01												
DINITROPHENOL, 2,4-	1.66E+01												
DINITROTOLUENE, 2,4-	4.47E+01												
ENDOSULFAN	3.16E+03												
ENDRIN	1.70E+03												
ETHYLBENZENE	5.75E+02	3.43E-03	2.00E+02	1.00E+01	2.00E+02	5.03E+01	1.25E+07	8.75E+04	8.00E+01	3.75E+00	8.75E+00	5.78E+01	1.79E+03
ETHYLENE DIBROMIDE	4.40E+01	6.73E-04	4.55E-03	0.00E+00	4.55E-03	4.46E-04	2.84E+02	1.01E+01	7.09E-04	8.52E-05	1.01E-03	1.13E-03	3.50E-02
FLUORANTHENE	3.80E+04												
FLUORENE	7.30E+03												
HEPTACHLOR	2.19E+04	1.48E-03	7.69E-04		7.69E-04	1.71E-02	4.81E+01	7.80E-01	2.71E-02	1.44E-05	7.80E-05	1.70E-02	5.27E-01
HEPTACHLOR EPOXIDE	2.34E+04	3.16E-05	3.85E-04		3.85E-04	4.28E-01	2.40E+01	1.83E+01	6.80E-01	7.21E-06	1.83E-03	4.26E-01	1.32E+01
HEXACHLOROBENZENE	1.20E+06	1.70E-03	2.17E-03		2.17E-03	2.31E+00	1.36E+02	1.92E+00	3.67E+00	4.08E-05	1.92E-04	2.29E+00	7.10E+01
HEXACHLOROBUTADIENE	2.90E+04	2.56E-02	4.55E-02		4.55E-02	7.72E-02	2.84E+03	2.66E+00	1.23E-01	8 52E-04	2.66E-04	7.75E-02	2.40E+00
HEXACHLOROCYCLOHEXANE, GAMMA (gamma-HCH)	3.72E+03												
HEXACHLOROETHANE	2.00E+04	9.85E-03	2.50E-01		2.50E-01	7.61E-01	1.56E+04	3.81E+01	1.21E+00	4.69E-03	3.81E-03	7.62E-01	2.36E+01
INDENO(1,2,3-cd)PYRENE	1.60E+06												
METHOXYCHLOR	7.94E+04												
METHYL ETHYL KETONE	3.55E+00	5.77E-05	2.00E+02	4.20E+01	2.00E+02	1.84E+01	1.25E+07	5.20E+06	2.93E+01	3.75E+00	5.20E+02	3.46E+02	1.07E+04
METHYL ISOBUTYL KETONE	3.09E+00	1.38E-04	1.60E+01	2.00E+00	1.60E+01	5.38E-01	1.00E+06	1.74E+05	8.55E-01	3.00E-01	1.74E+01	1.16E+01	3.59E+02
METHYL TERT BUTYL ETHER	2.70E+01	5.91E-04	1.00E+02	0.00E+00	1.00E+02	6.85E+00	6.25E+06	2.54E+05	1.09E+01	1.88E+00	2.54E+01	2.38E+01	7.39E+02
METHYLENE CHLORIDE	8.80E+00	3.19E-03	2.13E+00	6.00E+02	6.00E+02	2.48E+00	3.75E+07	2.82E+05	3.95E+00	1.13E+01	2.82E+01	2.71E+01	8.41E+02
METHYLNAPHTHALENE, 2-	7.20E+02	2.90E-04	1.42E+01	0.00E+00	1.42E+01	5.29E+01	8.88E+05	7.34E+04	8.41E+01	2.66E-01	7.34E+00	5.73E+01	1.78E+03
NAPHTHALENE	1.29E+03	1.18E-03	1.42E+01	5.00E+00	1.42E+01	2.32E+01	8.88E+05	1.81E+04	3.70E+01	2.66E-01	1.81E+00	2.44E+01	7.56E+02
PENTACHLOROPHENOL	3.16E+04	2.80E-06	1.40E-02		1.40E-02	2.37E+02	8.75E+02	7.50E+03	3.77E+02	2.63E-04	7.50E-01	2.36E+02	7.32E+03
PHENANTHRENE	1.40E+04												
PHENOL	9.12E+01	1.30E-06	5.20E+01	0.00E+00	5.20E+01	5.47E+03	3.25E+06	6.00E+07	8.70E+03	9.75E-01	6.00E+03	9.19E+03	2.85E+05
PYRENE	3.80E+04												
STYRENE	3.09E+00	2.61E-03	1.75E+00	5.00E+00	5.00E+00	8.88E-03	3.13E+05	2.87E+03	1.41E-02	9.38E-02	2.87E-01	2.47E-01	7.66E+00
TETRACHLOROETHANE, 1,1,1,2-	5.40E+01	1.10E-02	1.35E-01		1.35E-01	9.95E-04	8.45E+03	1.84E+01	1.58E-03	2.53E-03	1.84E-03	3.72E-03	1.15E-01
TETRACHLOROETHANE, 1,1,2,2-	4.57E+01	3.80E-04	1.72E-02	7.44E-03	1.72E-02	3.11E-03	1.08E+03	6.81E+01	4.95E-03	3.23E-04	6.81E-03	7.55E-03	2.34E-01
TETRACHLOROETHYLENE	4.68E+02	2.04E-03	1.92E+00	1.10E+01	1.10E+01	3.79E+00	6.88E+05	8.09E+03	6.02E+00	2.06E-01	8.09E-01	4.40E+00	1.36E+02
THALLIUM													
TOLUENE	2.70E+02	6.68E-03	8.00E+01	2.90E+01	8.00E+01	4.85E+00	5.00E+06	1.80E+04	7.71E+00	1.50E+00	1.80E+00	6.88E+00	2.13E+02
TRICHLOROBENZENE, 1,2,4-	9.20E+03	1.42E-03	1.80E+00	3.60E-02	1.80E+00	1.75E+01	1.13E+05	1.90E+03	2.78E+01	3.38E-02	1.90E-01	1.75E+01	5.43E+02
TRICHLOROETHANE, 1,1,1-	1.57E+02	2.31E-02	2.00E+02	3.00E+01	2.00E+02	2.04E+00	1.25E+07	1.30E+04	3.24E+00	3.75E+00	1.30E+00	5.18E+00	1.61E+02
TRICHLOROETHANE, 1,1,2-	3.09E+02	9.10E-04	6.25E-02	3.00E+01	3.00E+01	1.53E+01	1.88E+06	4.95E+04	2.43E+01	5.63E-01	4.95E+00	1.86E+01	5.77E+02
TRICHLOROETHYLENE	1.24E+02	9.12E-03	5.88E-01	5.00E+00	5.00E+00	1.02E-01	3.13E+05	8.22E+02	1.62E-01	9.38E-02	8.22E-02	2.11E-01	6.55E+00
TRICHLOROPHENOL, 2,4,5-	8.90E+01												
TRICHLOROPHENOL 2,4,6-	2.00E+03	4.00E-06	3.00E-01		3.00E-01	2.25E+02	1.88E+04	1.13E+05	3.58E+02	5.63E-03	1.13E+01	2.31E+02	7.15E+03
VINYL CHLORIDE	9.77E+01	2.78E-02	1.19E-02	0.00E+00	1.19E-02	6.28E-05	7.44E+02	6.42E-01	9.98E-05	2.23E-04	6.42E-05	2.42E-04	7.50E-03
XYLENES	3.02E+02	5.27E-03	6.00E+01	3.06E+00	6.00E+01	5.16E+00	3.75E+06	1.71E+04	8.20E+00	1.13E+00	1.71E+00	6.90E+00	2.14E+02

Assumption: Soil Particle Volume = 60%, Soil Gas Volume = 30%, Soil Water Volume = 10%

Particle Density = 2.65 gm/cu cm, Bulk Density = 1.6 gm/cu cm

Degradation adjustment factor = 31, Foc = 0.001

Appendix B.1.11: Unit Conversion for Soil to Indoor Air Vapour Transport Model (S/IA Eq.7).

Unit Conversions Carried Out to Obtain Soil to Indoor Air Vapour Transport Model (S/IA Eq.7).

Equation Utilized in the Vapour Transport Model are:

Eq. (1) $C_{sw} = C_{sp} / (K_{oc} \times f_{oc})$

Eq. (2) $C_{sg} = (C_{sw} \times H) / (R \times T)$

Eq. (3) $C_{sp} = C_{sg} \times R \times T \times H^{-1} \times K_{oc} \times f_{oc}$

Eq. (4) $C_{sg} = [\text{Indoor Air}] \times D$

Eq. (5) $C_{sp} = [\text{Indoor Air}] \times D \times R \times T \times H^{-1} \times K_{oc} \times f_{oc}$

Eq. (6) $C_{sg} = [\text{Indoor Air}] \times 10^4$

Eq. (7) $C_{sp} = [\text{Indoor Air}] \times H^{-1} \times K_{oc} \times 2.4 \times 10^{-7}$

where:
C_{sw} - contaminant concentration dissolved in soil water (ug/ml).
C_{sp} - contaminant concentration absorbed to soil particles (ug/g).
C_{sg} - contaminant concentration in soil gas (ug/m^3).
K_{oc} - organic carbon partitioning coefficient (ml/g).
f_{oc} - organic fraction of dry soil (g/g) = 0.001 for this application.
H - Henry's Law constant (atm.m^3/mol.).
R - Gas Constant = 0.082 atm.L/mol.°K for this application.
T - Absolute Temperature = 293°K for this application.
[Indoor Air] - Target indoor air concentration of the contaminant (ug/m^3).
D - Dilution factor for the contaminant in the soil gas phase vs the target indoor air concentration = 10^4 (dimensionless) for this application.

The following unit conversions were carried out to obtain Eq (7):

$C_{sp} = C_{sg} \times R \times T \times H^{-1} \times K_{oc} \times f_{oc}$ eq. (3)

$C_{sp} = [\text{Indoor Air}] \times 10^4 \times R \times T \times H^{-1} \times K_{oc} \times f_{oc}$ from eq. (4) , eq. (5) and eq. (6)

$$C_{sp}\ (\text{ug/g}) = \frac{[\text{Ind. Air (ug/m}^3)] \times 10^4 \times R\ (\text{atm.L/mol.°K}) \times T\ (\text{°K}) \times K_{oc}\ (\text{ml/g}) \times f_{oc}\ (\text{g/g})}{H\ (\text{atm.m}^3/\text{mol.})}$$

$$C_{sp}\ (\text{ug/g}) = \frac{[\text{Ind. Air (ug/m}^3)] \times 10^4 \times 0.082\ (\text{atm.L/mol.°K}) \times 293\text{°K} \times (\text{ml/g}) \times 0.001(\text{unitless})}{H\ (\text{atm.m}^3/\text{mol.})}$$

$$C_{sp}\ (\text{ug/g}) = \frac{[\text{Ind.Air (ug/m}^3)] \times 10^4 \times 24\ (\text{L}) \times K_{oc}\ (\text{ml/g}) \times 10^{-3}}{H\ (\text{m}^3)}$$

$$C_{sp}\ (ug/g) = \frac{[\text{Ind. Air}\ (ug/m^3)] \times 10^4 \times 24\ (m^3 \times 10^{-3}) \times K_{oc}\ (m^3 \times 10^{-6}) \times (g^{-1}) \times 10^{-3}}{H\ (m^3)}$$

$$C_{sp}\ (ug/g) = \frac{[\text{Ind. Air}\ (ug)] \times 10^4 \times 24 \times 10^{-3} \times K_{oc} \times 10^{-6} \times (g^{-1}) \times 10^{-3}}{H}$$

$$C_{sp}\ (ug/g) = \frac{[\text{Ind. Air}] \times 10^4 \times 24 \times K_{oc} \times 10^{-12}\ (ug/g)}{H}$$

$$C_{sp}\ (ug/g) = [\text{Ind. Air}] \times H^{-1} \times K_{oc} \times 24 \times 10^{-8}\ (ug/g)$$

$$C_{sp} = [\text{Ind. Air}] \times H^{-1} \times K_{oc} \times 2.4 \times 10^{-7} \quad \text{eq. (7)}$$

Appendix B.2: Soil:Air Degassing Modelling for VOCs

MOEE Soil:Air Toxics Models

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INTRODUCTION:

In response to the need to assess the impact of emissions from contaminated soil and special land fil sites on the local air quality, the Environmental Monitoring and Reporting Branch was requested to provide model estimates of maximum contamination concentrations in soil or land fill that would be acceptable according to air quality standards under the current Regulation 308. The following two scenarios were modelled; 1) an area covered by contaminated soil, and 2) a land fill with a clean porous cap overlaying contaminated soil.

For the first situation, the worst case scenario would occur if the following processes act together:

1. the contaminants under the clean, porous cap volatilize and diffuse through the porous cap and,
2. the atmospheric pressure and temperature changes in time to produce a negative pressure differential between the atmosphere and the land fill which acts to pump the contaminants out.

The above situation can only be modelled by considering both the atmospheric resistance and the porous cap resistance to the diffusion of contaminants.

MODELLING APPROACH:

Simulating emissions from a land fill or from a contaminated liquid pool requires modelling the behaviour of the interaction between the source (on or under the ground) and the air above ground. For this purpose, a two dimensional (downwind and vertical) Eulerian-based model (MOEE's Toxic Model) for simulating toxic transport is used as a base. This model was developed by Concord Environmental Corporation for use by MOEE (Rooney et. al. 1988).

The model provides cross-wind integrated concentrations at different levels in the vertical and at different locations directly over and downwind of a source. The cross-wind integrated concentration can be related to the plume centre-line and cross-wind concentration by imposing on it, a Gaussian spread term. For the present application, a Gaussian spread term, based on the MOEE's Toxic Model, was incorporated on the cross-wind integrated concentration. This spread is applied to contributions from each segment making up the area source and for all vertical levels. Since a stable atmosphere (one of three stability classes) would produce the highest concentrations near the ground, only the stable atmosphere formulation for plume spread has been incorporated in the model. The plume spread for other atmospheric conditions will be implemented in the future.

The report by Rooney et. al., 1988. describes the grid resolution needed in the model to produce reasonable results. For the present applications, a number of other tests have been made. The model assumes no reaction between the chemical species of concern and the soil medium containing the chemical. Modelling chemical bonding to soil particles is beyond the technical capability of existing models.

For simulations over a liquid pool, the MOEE's Toxic Model assumes a smooth liquid surface and the existence of a laminar sublayer above it. However, for this application, the source may only be distinguished from the surroundings by the presence of a pollutant on the surface. Thus, for the present application, the meteorological parameters over the source and receptor areas are set identical to each other. This gives higher values of fluxes from the ground than would be estimated for evaporation from a liquid pool.

Information needed for running the model (chemical formula, vapour pressures, solubility and Henry's Law constants) are obtained either from physical and chemical databases or are calculated from general definition (Henry's Law constants, when not available, from vapour pressures and solubility) or formula given in chemical engineering handbooks (molecular diffusivity coefficient of the vapour of the species of concern in the air from Perry, 1950).

A realistic upper bound temperature of 30°C is assumed for the runs. Values for temperature dependent parameters (e.g. vapour pressure and solubility in water) corresponding to 30°C are searched for. When a value of 30°C is not available, the value for the closest temperature (usually 20 or 25°C) is used without further adjustments.

MODEL INTERCOMPARISON:

Flux Estimation

The fluxes of contaminant from an open liquid pool estimated using the MOEE Toxic Model has been compared with MacKay and Matsugu's (1973) formula. The only meteorological parameter that MacKay and Matsugu's formula uses is wind velocity "U". On the other hand, the MOEE model calculates a vertical wind profile based on atmospheric stability, friction velocity and surface roughness. Wind velocity at a specific height above ground (commonly assumed to be 10m) can be produced by a combination of the parameters used in the MOEE model. Thus the MOEE model would produce slightly different fluxes for different combinations of parameters for the same wind speed. It is sufficient to note that the range of possible flux values produced by the MOEE model for a given 10 m wind speed for a smooth surface, over which a laminar sublayer occurs, covers the estimated value by MacKay and Matsugu's (1973) formula. Over a rough soil surface the MOEE Toxic Model gives higher fluxes than would be obtained for evaporation from a liquid pool.

Comparisons with AERIS

A commonly used model for estimating multi-pathway exposure is the AERIS model (AERIS Software Inc. 1991) developed by SENES Corporation. A part of this model deals with estimating outdoor air concentrations from contaminated soil, at breathing height. Contributions from an open liquid pool is not estimated on the AERIS model. In the AERIS model, the minimum thickness of a clean soil cap overlaying a contaminant is 0.5 m. The calculation of soil resistances in the AERIS model is identical to that employed in the MOEE Toxic Model. The approach in solving for the ambient concentration above a land fill site differs in the two models:

1) The MOEE Toxic Model employs a variable grid approach in the horizontal and vertical direction to allow higher resolution closer to the source. This should resolve the concentration profile better than the bulk approach (without any grid) employed in the AERIS model and would also allow specific atmospheric conditions to be modelled, a feature not found in the AERIS model. MOEE's Toxic Model directly simulates atmospheric dispersion through molecular and turbulent diffusivity while AERIS does not. Thus air concentrations over receptors not immediately above the source can also be simulated by the MOEE model, but not by AERIS.

2) The MOEE Toxic Model employs a novel integrated approach that would allow the concentration in the first grid under the air medium (inside the ground) to be solved for, without making any prior assumption. In the AERIS model, this is done in a multi-step procedure by assuming the ambient concentration to be zero as compared to the concentration in the landfill.

In addition to the above advantages, the MOEE's Toxic Model also has the ability to treat different source types like particulate suspension, aqueous volatilizations from an open space, and stack emissions. It can also model for specific meteorological conditions. Based on these considerations, the MOEE Toxic Model is a more flexible and exact tool for estimating toxic fluxes for the present application.

MODEL INPUT:

The list of chemicals that are modelled in this study are those that are in both the Materials Management Policy, the revised Soil Clean-up/Decommissioning Policy and in the Air Quality Criteria list. The entire list of organic chemicals in the Materials Management Policy, together with the pertinent physical and chemical information that are available for this modelling effort is given in Table A1. The chemicals that are common to both the two policies and the Air Quality Criteria are indicated in the sixth column by the species number according to the position of the species on the Air Quality Criteria list.

The horizontal grid system is set up in such a way that 100 m of receptor, represented by 10 horizontal grids, is downwind of the source area which is also represented by 10 equal size segments. The vertical grid has 200 expanding grid cells between the ground and 10 m height (taken to be the top of the surface layer). An expansion factor of 1.05 is used giving a very fine spatial resolution to the grid close to the ground. This is sufficient to resolve the sharp concentration gradient near the ground. A number of situations representing a number of source dimensions and characteristics have been modelled. Two representative cases are presented for each of the two scenarios. Sample input files and the detailed results are given in Tables A1 to A4 and Tables B1 to B4 for the two cases respectively.

MODEL RESULTS:

Without Soil Resistence

Table 1 represents the highest species concentrations in soil that would still produce an ambient concentration complying with the MOEE Ambient Air Quality Criteria at four heights above ground (0.5, 1.0, 1.5, 2.0 m as indicated in the second column). The model is run for a pure liquid pool. If the model prediction for ambient air concentration for a given chemical species indicates that the maximum at any height above ground exceeds the Air Quality Criteria value, then a proration, based on the assumption that the relationship between the source mole fraction of the species that can exist in the liquid pool without exceeding the ambient air concentration is set out in the air quality standard. The other component in the liquid pool is assumed to be water.

This maximum mass fraction is then used to calculate the maximum mass fraction of the species in soil (last four columns for two source sizes and for comparison with the 1/2 hour and 24 hour standard) by assuming an average bulk soil density of 1.3 g/cc. For the preceeding comparison of the modelled values with the standard, it is assumed that the meteorological conditions (i.e. wind speed, wind direction and stability) producing the modelled concentrations persist for the duration specified in the Air Quality Criteria. Thus the comparison with the 24 hour air quality standard is conservative.

With Soil Resistance

The runs for the case with soil resistance (Table 2) were made by assuming that the chemical species of interest is in a solution with water as a solvent. It is further assumed that the species makes up 50 percent of the solution by weight. However, in most cases, this assumption would give a concentration in solution that is much higher than the actual solubility of the species in water. To prevent the modeller from generating and using concentration estimates based on unrealistically high mass fractions, a check is placed in the programme that resets the mass fraction to the maximum allowed, based on the given solubility values for the species in water, if the input mass fraction violates the solubility limit. The programme user will then be notified of this change.

If no water solubility limit for a species is given, the initial assumed mass fraction of 0.5 is used to generate the ambient concentration. If this ambient concentration exceeds the Ambient Air Quality Criteria (AAQC), a back calculation based on a linear relationship between ambient concentration and aqueous mole fraction (as in the no soil resistance case above) will be employed to derive the maximum fraction in the solution.

The model is only run for species with available Henry's Law constants. Solubility values of all these species are also available. The assumed initial mass fraction of 0.5 for these species is higher than the solubility values of all the species. Thus the mass fractions are set to what is allowed by the solubility. Applying these values to the model indicate that most of these realistic species concentrations in solution would produce ambient concentration exceeding the AAQCs for many of the situations simulated in this report. For modelling concentrations that do not exceed the AAQC values, the maximum mass fraction if flagged as "N/A".

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Perry, J.H. (ed.) (1950). Perry's Chemical Engineer's Handbook, 3rd Edition. McGraw-Hill, New York.

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MOEE SOIL:AIR TOXIC MODEL TABLES

TABLE 1. Maximum allowable soil concentrations for surface soils

SOURCE DIMENSION (M) =10 x 10 SOURCE DIMENSION (M) = 100 x 100
ROUGHNESS OVER SOURCE (M) =0.050 ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) =0.100 FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	MTS*** (M)	1/2 HR* SOIL CCNC(ppmm)*	24 HR* SOIL CCNC(ppmm)**	1/2 HR* SOIL CCNC(ppmm)**	24 HR* SOIL CCNC(ppmm)**
Toluene	2.3	0.356E+04	0.356E+04	0.385E+03	0.385E+03
	1.5	0.214E+04	0.214E+04	0.278E+03	0.278E+03
	1.0	0.116E+04	0.116E+04	0.212E+03	0.212E+03
	0.5	0.532E+03	0.532E+03	0.169E+03	0.169E+03
Ethylbenzene	2.0	0.190E+05	-0.999E+01	0.208E+04	-0.999E+01
	1.5	0.115E+05	-0.999E+01	0.150E+04	-0.999E+01
	1.0	0.628E+04	-0.999E+01	0.114E+04	-0.999E+01
	0.5	0.288E+04	-0.999E+01	0.915E+03	-0.999E+01
Styrene	2.0	0.259E+04	0.259E+04	0.280E+03	0.280E+03
	1.5	0.155E+04	0.155E+04	0.202E+03	0.202E+03
	1.0	0.846E+03	0.846E+03	0.154E+03	0.154E+03
	0.5	0.387E+03	0.387E+03	0.123E+03	0.123E+03
Napthalene	2.0	0.158E+05	0.992E+04	0.172E+04	-0.108E+04
	1.5	0.952E+04	0.598E+04	0.124E+04	0.777E+03
	1.0	0.521E+04	0.326E+04	0.946E+03	0.592E+03
	0.5	0.238E+04	0.149E+04	0.756E+03	0.472E+03
Chloromethane	2.0	0.654E+03	0.229E+03	0.709E+02	0.248E+02
	1.5	0.390E+03	0.137E+03	0.152E+02	0.179E+02
	1.0	0.212E+03	0.741E+02	0.390E+02	0.137E+02
	0.5	0.972E+02	0.340E+02	0.314E+02	0.110E+02
Bromomethane	2.0	0.430E+03	0.145E+03	0.465E+02	0.157E+02
	1.5	-0.257E+03	0.868E+02	0.336E+02	0.113E+02
	1.0	0.140E+03	0.471E+02	0.256E+02	0.863E+01
	0.5	0.640E+03	0.216E+02	0.205E+02	0.692E+01
Carbon tetrachloride	2.0	0.357E+04	0.119E+04	0.387E+03	0.123E+03
	1.5	0.214E+04	0.715E+03	0.279E+03	0.930E+02
	1.0	0.117E+04	0.389E+03	0.212E+03	0.708E+02
	0.5	0.534E+03	0.178E+03	0.170E+03	0.567E+02
1,2-Dichloroethane	2.0	0.321E+04	0.107E+04	0.348E+03	0.116E+03
	1.5	0.193E+04	0.643E+03	0.251E+03	0.837E+02
	1.0	0.105E+04	0.349E+03	0.191E+03	0.638E+02
	0.5	0.479E+03	0.160E+03	0.153E+03	0.511E+02
1,1-Dichloroethylene	2.0	0.541E+01	0.270E+01	0.584E+00	0.292E+00
	1.5	0.323E+01	0.162E+01	0.421E+00	0.211E+00
	1.0	0.176E+01	0.878E+00	0.321E+00	0.160E+00
	0.5	0.804E+00	0.402E+00	0.257E+00	0.128E+00
Trichloroethylene	2.0	0.527E+05	0.180E+05	0.599E+04	0.198E+04
	1.5	0.323E+05	0.109E+05	0.432E+04	0.143E+04
	1.0	0.178E+05	0.594E+04	0.330E+04	0.109E+04
	0.5	0.823E+04	0.273E+04	0.264E+04	-0.872E+03
1,2-Dichloropropane	2.0	0.226E+04	0.226E+04	0.244E+03	0.244E+03
	1.5	0.135E+04	0.135E+04	0.176E+03	0.176E+03
	1.0	0.736E+04	0.736E+03	0.134E+03	0.134E+03
	0.5	0.337E+03	0.337E+03	0.107E+03	0.107E+03
Tetrachloroethylene	2.0	0.255E+05	0.104E+05	0.282E+04	0.113E+04
	1.5	0.154E+05	0.624E+04	0.284E+04	0.315E+03
	1.0	0.846E+04	0.340E+04	0.155E+04	0.621E+03
	0.5	0.389E+04	0.156E+04	0.124E+04	0.497E+03
Chlorobenzene	2.0	0.167E+05	0.999E+01	0.182E+04	-0.999E+01
	1.5	0.100E+05	0.999E+01	0.132E+04	-0.999E+01
	1.0	0.549E+04	0.999E+01	0.100E+04	-0.999E+01
	0.5	0.252E+04	0.999E+01	0.301E+03	-0.999E+01
1,2-Dichlorobenzene	2.0	0.538E+06	-0.999E+01	0.122E+06	-0.999E+01
	1.5	0.422E+06	-0.999E+01	0.913E+05	-0.999E+01
	1.0	0.291E+06	-0.999E+01	0.742E+05	-0.999E+01
	0.5	0.160E+06	-0.999E+01	0.573E+05	-0.999E+01

* 1/2 HR and 24 HR refer to the averaging time of the air quality standard used in the assessment

** ppmm is parts per million by mass in the soil

*** MTS are heights above ground at which the assessment was made (i.e. to meeting the Air Quality Criteria)

-0.999E+01 indicates that no standard exists for the species under consideration

TABLE 2. Maximum allowable soil concentration for buried contaminated soil

		LAND FILL 100M X 100M		LAND FILL 1CM X 10M	
CHEMICALS	MTS*** (M)	1/2 HR* SOIL CCNC(ppmm)**	24 HR* SOIL CCNC(ppmm)**	1/2 HR* SOIL CCNC(ppmm)**	24 HR* SOIL CCNC(ppmm)**
Toluene	2.0	0.117E+02	0.117E+02	N/A	N/A
	1.5	0.873E+01	0.873E+01	0.258E+03	0.258E+03
	1.0	0.668E+01	0.668E+01	0.145E+03	0.145E+03
	0.5	0.519E+01	0.519E+01	0.724E+02	0.724E+02
Styrene	2.0	0.190E+02	0.190E+02	0.712E+03	0.712E+03
	1.5	0.142E+02	0.142E+02	0.434E+03	0.434E+03
	1.0	0.109E+02	0.109E+02	0.244E+03	0.244E+03
	0.5	0.847E+01	0.847E+01	0.122E+03	0.122E+03
Napthalene	2.0	0.316E+01	0.198E+01	N/A	N/A
	1.5	0.237E+01	0.148E+01	N/A	N/A
	1.0	0.181E+01	0.113E+01	N/A	0.269E+02
	0.5	0.141E+01	0.879E+00	0.215E+02	0.122E+03
1,2-Dichloroethane	2.0	N/A	N/A	N/A	N/A
	1.5	N/A	N/A	N/A	N/A
	1.0	N/A	N/A	N/A	N/A
	0.5	N/A	N/A	N/A	N/A
1,2-Dichloropropane	2.0	0.324E+02	0.324E+02	0.111E+04	0.111E+04
	1.5	0.243E+02	0.243E+02	0.675E+03	0.675E+03
	1.0	0.186E+02	0.186E+02	0.380E+03	0.380E+03
	0.5	0.144E+02	0.144E+02	0.190E+03	0.190E+03
Chlorobenzene	2.0	0.291E+02	-0.999E+01	N/A	-0.999E+01
	1.5	0.218E+02	-0.999E+01	N/A	-0.999E+01
	1.0	0.167E+02	-0.999E+01	0.367E+03	-0.999E+01
	0.5	0.130E+02	-0.999E+01	0.184E+03	-0.999E+01
1,2-Dichlorobenzene	2.0	N/A	-0.999E+01	N/A	-0.999E+01
	1.5	N/A	-0.999E+01	N/A	-0.999E+01
	1.0	N/A	-0.999E+01	N/A	-0.999E+01
	0.5	N/A	-0.999E+01	N/A	-0.999E+01

* 1/2 HR and 24 HR refer to the averaging time of the air quality standard used in the assessment

** ppmm is parts per million by mass in the soil

*** MTS are heights above ground at which the assessment was made (i.e. to meeting the AIR Quality Criteria)

-0.999E+01 indicates that no standard exists for the species under consideration

N/A indicates that the mass fraction permitted by the solubility of the species in water would not produce an ambient concentration above the standard in the Air Quality Criterion list.

Table A1. Input physical and chemical data to run OME's Toxic Model. The species are based on the Material Policy List of chemicals.

CHEMICALS	CAS	FORMULA	MOL_WT	VP_P (Pa)	CH_NO	R	DAB(10E-6) (M2/S)	HENRY'S (ATM M3/GMCL)	SOLUBILITY (MG/L)
MONOCYC AROMATICS									
Benzene	71-43-2	C6-M6	78.11	12221.20	21	106.44	8.4617	5.550E+03	1.800E+03
Toluene	108-88-3	C7.M8	94.14	4570.62	291	88.32	7.6840	6.666E+03	5.150E+02
Xylene			0.00	0.00	309	0.00	-9.9999	-9.999E+00	-9.999E+00
O-xylene	95-47-6	C3.M10	106.17	1163.99	N/A	78.31	7.1152	-9.999E+00	-9.999E+00
M-xylene	108-38-3	C3.M10	106.17	1423.99	N/A	78.31	7.1152	-9.999E+00	-9.999E+00
P-xylene	106-42-3	C3.M10	106.17	1510.65	N/A	78.31	7.1152	-9.999E+00	-9.999E+00
Ethylbenzene	100-41-4	C3.M10	106.17	1699.98	119	78.31	7.1152	-9.999E+00	-9.999E+00
Styrene	100-42-5	C3.M8	104.15	1266.65	276	79.83	7.2135	8.290E.04	3.505E+03
POLYCYCLIC AROMATICS									
Napthalene	92-20-3	C10.M8	128.17	18.67	213	64.87	6.4588	0.460E+03	-9.999E+00
1-Methyl napthalene	90-12-0	C11.M10	142.20	-999999.00	N/A	58.47	6.0966	-9.999E+00	-9.999E+00
2-Methyl napthalene	91-57-6	C11.M10	142.20	-999999.00	N/A	58.47	6.0966	-9.999E+00	-9.999E+00
Anthracene	120-12-7	C14.M10	178.23	-999999.00	N/A	46.65	5.4144	-9.999E+00	-9.999E+00
Phenanthrene	85-01-8	C14.M10	178.23	-999999.00	N/A	46.65	5.4144	-9.999E+00	-9.999E+00
Benzo(a)anthracene	56-55-3	C17.M13	217.29	-999999.00	N/A	38.26	4.3666	-9.999E+00	-9.999E+00
Chrysene	218-01-9	C18.M12	228.29	-999999.00	N/A	36.42	4.7469	-9.999E+00	-9.999E+00
Pyrene	129-00-0	C11.M10	142.20	-999999.00	N/A	58.47	4.0966	-9.999E+00	-9.999E+00
Fluoranthene	206-44-0	C16.M10	202.26	-999999.00	N/A	41.11	5.0670	-9.999E+00	-9.999E+00
Dibenz(a,h)anthracene		C22.M14	278.35	-999999.00	N/A	29.87	4.2728	-9.999E+00	-9.999E+00
Benzo(a)pyrene	50-32-8	C20.M12	252.31	-999999.00	23	32.95	4.5049	-9.999E+00	-9.999E+00
Benzo(b)fluoranthene	205-99-2	C20.M12	252.31	-999999.00	N/A	32.95	4.5049	-9.999E+00	-9.999E+00
Benzo(k)fluoranthene	207-08-9	C20.M12	252.31	-999999.00	N/A	32.95	4.5049	-9.999E+00	-9.999E+00
Indeno(1,2,3-cd)pyrene	193-39-5	C23.M14	288.35	-999999.00	N/A	28.83	4.1808	-9.999E+00	-9.999E+00
Benzo(ghi)perylene	191-24-2	C24.M14	302.38	-999999.00	N/A	27.50	4.0917	-9.999E+00	-9.999E+00
Camphene	79-92-5	C10.M16	135.24	-999999.00	N/A	61.02	6.1841	-9.999E+00	-9.999E+00
1-Chloronapthalene	90-13-1	C14.M10.CL	213.69	-999999.00	N/A	38.91	5.1671	-9.999E+00	-9.999E+00
2-Chloronapthalene	91-58-7	C19.37.CL	270.72	-999999.00	N/A	30.71	4.5318	-9.999E+00	-9.999E+00
Fluorene	86-73-7	C13.M9	165.21	-999999.00	N/A	50.32	5.6409	-9.999E+00	-9.999E+00
Indole	120-72-9		0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
Perylene	198-55-0	C20.M12	-287.77	-999999.00	N/A	28.89	4.4762	-9.999E+00	-9.999E+00
Acenaphthene	83-32-9	C12.M10	154.21	-999999.00	N/A	53.91	5.3420	-9.999E+00	-9.999E+00
5-Nitro acenaphthene	602-87-9	C12.M9.M.02	199.21	-999999.00	N/A	41.73	5.5669	-9.999E+00	-9.999E+00
Acenaphthylene	208-96-8		0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
PHENOLICS									
2,4-Dinitrophenol	51-28-5	C6.M4.M2.05	184.11	-999999.00	N/A	45.16	6.9080	-9.999E+00	-9.999E+00
Phenol	108-95-2	C6.M6.0	94.11	-999999.00	236	88.34	8.0962	-9.999E+00	-9.999E+00
M-cresol	108-39-4	C7.M8.0	108.14	-999999.00	N/A	76.88	7.4326	-9.999E+00	-9.999E+00
O-cresol	95-48-7	C7.M8.0	108.14	-999999.00	N/A	76.88	7.4326	-9.999E+00	-9.999E+00
P-cresol	106-44-5	C7.M8.0	108.14	-999999.00	N/A	76.88	7.4326	-9.999E+00	-9.999E+00
2,4-Dimethylphenol	105-67-9	C9.M12.0	136.19	-999999.00	N/A	61.05	6.4737	-9.999E+00	-9.999E+00
4-Nitrophenol	100-02-7	C6.M5.M.03	174.56	-999999.00	N/A	47.63	7.2627	-9.999E+00	-9.999E+00
4-Chloro-3-methylphenol	59-50-7	C7.M7.CL.0	142.58	-999999.00	N/A	58.31	6.8670	-9.999E+00	-9.999E+00
2-Chlorophenol	95-57-8	C6.M5.CL.0	128.56	423.33	N/A	64.67	7.3762	-9.999E+00	-9.999E+00
4,6-Dinitro-o-cresol	534-52-1	C6.M6.M2.05	186.12	-999999.00	N/A	0.00	6.3220	-9.999E+00	-9.999E+00
2,6-dichlorophenol	87-65-0	C6.M4.CL2.0	163.00	-999999.00	N/A	51.01	6.3519	-9.999E+00	-9.999E+00
2,4-Dichlorophenol	120-83-2	C6.M4.CL2.0	163.00	-999999.00	N/A	51.01	6.3519	-9.999E+00	-9.999E+00
2,3,4-Trichlorophenol	15950-66-0	C6.M3.CL3.0	197.45	-999999.00	N/A	42.11	6.4401	-9.999E+00	-9.999E+00

2,3,5-Trichlorophenol	933-78-8	C6.M3.CL3.0	197.45	-999999.00	N/A	42.11	6.4401	-9.999E+00	-9.999E+00
2,4,5-Trichlorophenol	95-95-4	C6.M3.CL3.0	197.45	-999999.00	N/A	42.11	6.4401	-9.999E+00	-9.999E+00
2,4,6-Trichlorophenol	88-06-2	C6.M3.CL3.0	197.45	-999999.00	N/A	42.11	6.4401	-9.999E+00	-9.999E+00
2,3,4,5-Tetrachlorophenol	4901-51-3	C6.M2.CL4.0	231.89	-999999.00	N/A	35.85	6.1020	-9.999E+00	-9.999E+00
2,3,4,6-Tetrachlorophenol	58-90-2	C6.M2.CL4.0	231.89	-999999.00	N/A	35.85	6.1020	-9.999E+00	-9.999E+00
2,3,5,6-Tetrachlorophen	935-95-5	C6.M2.CL4.0	231.89	-999999.00	N/A	0.00	6.1020	-9.999E+00	-9.999E+00
Pentachlorophenol	87-86-5	C6.M.CL5.0	268.34	-999999.00	234	30.98	5.3139	-9.999E+00	-9.999E+00
HALOGENATED ALIPHATICS									
Chloromethane	74-87-3	C.M3.CL	50.49	235208.00	191	164.67	13.3766	-9.999E+00	-9.999E+00
Bromomethane	74-83-9	C.M3.32	94.94	73651.20	190	87.57	10.2344	-9.999E+00	-9.999E+00
Dichloromethane			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
Trihalomethanes			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
Trichloromethane		C.M.CL3	119.38	7250.59	N/A	69.64	9.3770	-9.999E+00	-9.999E+00
Dibromochloromethane	124-48-1	C.M.322.CL	208.28	-999999.00	N/A	39.92	7.6786	-9.999E+00	-9.999E+00
Tribromomethane		C.M.323	252.73	182.66	N/A	32.90	7.4289	-9.999E+00	-9.999E+00
Carbon tetrachloride	56-23-5	C.CL4	153.82	4061.29	54	54.05	8.4267	-9.999E+00	-9.999E+00
1,1-Dichloroethane	75-34-3	C2.M4.CL2	98.96	8418.58	N/A	84.01	9.4192	-9.999E+00	-9.999E+00
1,2-Dichloroethane	107-06-2	C2.M4.CL2	98.96	2975.97	125	84.01	9.4192	8.290E+04	3.505E+03
1,1,2-Trichloroethane	79-00-5	C2.M3.CL3	133.40	750.66	N/A	62.32	8.4199	-9.999E+00	-9.999E+00
1,1,2,2-Tetrachloroethane	79-34-5	C2.M2.CL4	167.85	184.00	N/A	49.53	7.7056	-9.999E+00	-9.999E+00
Chloroethylene	75-01-4	C2.M3.CL	62.50	-999999.00	305	133.02	11.3604	2.400E+03	-9.999E+00
1,1-Dichloroethylene	75-35-4	C2.M2.CL2	96.50	103331.00	306	86.16	9.6439	-9.999E+00	-9.999E+00
Trichloroethylene	79-01-6	C2.M.CL3	96.94	12261.20	296	85.76	8.3502	-9.999E+00	-9.999E+00
1,2-Dibromoethane		C2.M4.322	131.39	2559.97	N/A	63.28	7.3085	-9.999E+00	-9.999E+00
Trans 1,2-Dichloroethylene	156-60-5	C2.M2.CL2	187.86	44971.50	N/A	44.26	9.0859	-9.999E+00	-9.999E+00
Cis-1,3-Dichloropropylene	10061-01-5	C2.M2.CL2	96.94	28955.70	N/A	85.76	9.6389	-9.999E+00	-9.999E+00
1,2-Dichloropropylene	78-87-5	C3.M6.CL2	96.94	8562.58	256	85.76	3.5902	2.800E+03	2.900E+03
Tetrachloroethylene	127-18-4	C2.CL4	112.99	3098.64	235	73.58	8.0966	-9.999E+00	-9.999E+00
Tranl,3-Dichloropropylene	10061-02-6	C3.M4.CL2	110.97	-999999.00	N/A	74.92	3.6083	-9.999E+00	-9.999E+00
Trichlorofluoromethane	75-69-4	C.CL3.F	165.83	114447.00	147	0.00	7.9959	-9.999E+00	-9.999E+00
HALOGENATED CYCLICS									
Chlorobenzene	108-90-7	C6.M5.CL	137.37	2029.31	211	60.52	7.4668	5.640E+03	4.380E+02
1,2-Dichlorobenzene	95-30-1	C6.M5.CL2	112.56	265.33	86	84.01	7.1533	3.720E+03	1.405E+02
1,3-Dichlorobenzene	541-73-1	C6.M5.CL2	148.01	410.66	N/A	56.17	6.9756	-9.999E+00	-9.999E+00
1,4-Dichlorobenzene	106-46-7	C6.M5.CL2	148.01	146.67	N/A	56.17	6.9756	-9.999E+00	-9.999E+00
Total dichlorobenzenes			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
PESTICIDES									
Aldrin		C12.M8.CL6	364.91	-999999.00	N/A	22.78	4.5775	-9.999E+00	-9.999E+00
Aldrin+dieldrin			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
Carbaryl		C2.M11.M.02	201.22	-999999.00	N/A	41.32	5.5201	-9.999E+00	-9.999E+00
Chlordane		C10.M6.CL8	409.78	-999999.00	N/A	20.29	4.5456	-9.999E+00	-9.999E+00
DDT+metabolites			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
2,4-D		C8.M6.CL2.03	221.04	-999999.00	N/A	37.61	5.9362	-9.999E+00	-9.999E+00
Diazinon		C12.M21.M2.03.PS	304.35	-999999.00	N/A	27.32	4.2162	-9.999E+00	-9.999E+00
Dieldrin		C12.M8.CL6.0	380.91	-999999.00	N/A	21.83	4.5346	-9.999E+00	-9.999E+00
Endrin		C12.M8.C16.0	380.91	-999999.00	N/A	21.83	4.5346	-9.999E+00	-9.999E+00
Heptachor+hept epoxide			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
Lindane		C6.M6.CL6	290.83	-999999.00	173	28.59	5.5048	-9.999E+00	-9.999E+00
Methoxychlor		C16.M15.CL3	345.65	-999999.00	188	0.00	4.4512	-9.999E+00	-9.999E+00

Methyl parathion		C3.310.M.05.PS	291.26	-999999.00	N/A	31.59	4.9275	-9.999E+00	-9.999E+00
Nitrilotriacetic acid			0.00	0.00	218	0.00	-9.9999	-9.999E+00	-9.999E+00
Parathion		C10.M14.M.05.PS	291.26	-999999.00	N/A	28.54	4.5670	-9.999E+00	-9.999E+00
Silvex		C9.M7.CL3.03	269.51	799.99	N/A	30.85	5.4221	-9.999E+00	-9.999E+00
Toxaphene		C10.M10.CL8	413.81	-999999.99	N/A	20.09	4.4932	-9.999E+00	-9.999E+00
dixons+furans			0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00
PCB	unavailable		0.00	0.00	N/A	0.00	-9.9999	-9.999E+00	-9.999E+00

Table A2. Input file to specify the vertical grid setup and meteorological information for running the OME's Toxic Model

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0010.00000      ZSRF =TOP OF SURFACE REGION (M)
0010.00000      ZS1 =BOTTOM OF AERIAL SOURCE (M)
0100.00000      ZS2 =TOP OF AERIAL SOURCE (M)
0110.00000      ZTOP =TOP OF SOLUTION DOMAIN (M)
00200           NZCV1 =# OF C.V. IN SURFACE REGION
00000           NZCV2 =# OF C.V. BETWEEN SURFACE REGION AND SOURCE
00010           NZCV3 =# OF C.V. IN AERIAL SOURCE
00010           NZCV4 =# OF C.V. ABOVE AERIAL SOURCE
0001.05000      R1 =SURFACE LAYER GRID EXPANSION FACTOR (>10)
0010.00000      ZREF =REFERENC3 ELEVATION FOR PROPERTIES (M)
-0.000E-01      WSREF =REFERENCE SETTLING VELOCITY (M/S)
00.000E+00      VDREF =REFERENCE DEPOSITION VELOCITY (M/S)
01.470E-05      DAIR =MOLECULAR DIFFUSIVITY OF AIR (M2/S)
00.100E+25      TAUC =TIMESCALE OF CHEMICAL CONVERSION
00.100E+25      TAUW =TIMESCALE OF WET REMOVAL
00.000E-00      CIREF =REFERENCE CONCENTRATION LEVEL (KG/M**³)
00.100E-00      USR =SHEAR VELOCITY FOR INITIAL ROUGH SURFACE (M/S)
+0.100E-01      ZOMAXZ =MAXIMUM SURFACE ROUGHNESS IN DOMAIN (M)
0000.35000      VK =VON KARMAN'S CONSTANT
00002           ISTB =,1 NEUTRAL, 2 STABLE, 3 UNSTABLE
0300.00000      TBAR =AVERAGE BOUNDARY LAYER TEMPERATURE (K)
0001.20000      DEN =DENSITY OF AIR (KG/M**3)
1007.00000      CP =SPECIFIC HEAT OF AIR (J/KG/K)
0009.81000      G =GRAVITY (M/S**2)
0600.00000      HO =SURFACE HEAT FLUX (W/M**2)
1000.00000      ZI =INVERSION HEIGHT (M)
```

Table A3. Input data file to specify the horizontal grid setup, boundary conditions and source information (evaporation from a liquid pool) for running the OME's Toxic Model

```
00001           NSEC =NUMBER OF SECTIONS IN HORIZONTAL DOMAIN
0000.00000      XIN =START OF X DOMAIN SECTION (M)
0000.00000      XS1 =START OF GROUND SOURCE (M)
0100.00000      XS2 =END OF GROUND SOURCE (M)
0200.00000      XOUT =END OF HORIZONTAL SECTION (M)
00000           NXCV1 =# OF C.V. BEFORE GROUND SOURCE
00010           NXCV2 =# OF C.V. OVER GROUND SOURCE
00010           NXCV3 =# OF C.V. AFTER GROUND SOURCE
00.200E-00      ZOREF =SURFACE ROUGHNESS OVER GROUND (M)
00.200E-00      ZOSRC =SURFACE ROUGHNESS OVER SOURCE (M)
00000           IBNDC =0 C=0, IBNDC=1 C*VD=..., IBNDC=2 DC/DZ=0
00000           ISRC =0 CONCENTRATION, =1 FLUX, =2 STACK
00000           IEMM =EMISSION MECHANISM FLAG (SEE NOTES)
01.000E+02      AREA SOURCE CROSS WIND DIMENSION
01.000E+00      MASS FRACTION OF CHEMICAL
03.030E+02      TEMPERATURE OF LIQUID (K)
```

Table A4. Input data file to specify the horizontal grid setup, boundary conditions and source information (emission from a landfill site) for funning the OME's Toxic Model.

```
00001           NSEC =NUMBER OF SECTIONS IN HORIZONTAL DOMAIN
0000.00000      XIN =START OF X DOMAIN SECTION (M)
0000.00000      XS1 =START OF GROUND SOURCE (M)
0100.00000      XS2 =END OF GROUND SOURCE (M)
0200.00000      XOUT =END OF HORIZONTAL SECTION (M)
00000           NXCV1 =# OF C.V. BEFORE GROUND SOURCE
00010           NXCV2 =# OF C.V. OVER GROUND SOURCE
00010           NXCV3 =# OF C.V. AFTER GROUND SOURCE
00.100E-00      ZOREF =SURFACE ROUGHNESS OVER GROUND (M)
00.100E-00      ZOSRC =SURFACE ROUGHNESS OVER SOURCE (M)
00002           IBNDC =0 C=0, IBNDC=1 C*VD=..., IBNDC=2 DC/DZ=0
00000           ISRC =0 CONCENTRATION, =1 FLUX, =2 STACK
00002           IEMM =EMISSION MECHANISM FLAG (SEE NOTES)
01.000E+02      ASCD :AREA SOURCE CROSS WIND DIMENSION
01.000E+00      CT :CAP THICKNESS (M)
00.500E-00      EP :TOTAL POROSITY OF SOIL
00.600E-00      EPS :SOIL CAP AIR FILLED POROSITY
00.500E-00      EPW :WASTE POROSITY
01.000E+01      WP :WASTE BED THICKNESS (M)
0.2980E+02      TLF :LAND FILL TEMPERATURE (K)
03.080E+02      TLFF :FINAL LANDFILL TEMPERATURE (K)
07.700E+02      PLF :INITIAL BAROMETRIC PRESSURE IN LANDFILL (MMHG)
03.000E+04      PLFF :FINAL BAROMETRIC PRESSURE IN LANDFILL (MMHG)
01.000E+03      DENLIQ :DENSITY OF THE WASTE LIQUID (KG/M3)
00.500E-00      CI :WT.FRACTION OF CONSTITUENT I IN THE ORG. WASTE
                LIQ.
```

Tables B1 and B2 summarize the runs that have been made for the case without soil resistance and with soil resistance, respectively. Tables B3.1-18 and B4.1-10 present the extracted results for case without and with soil resistance simultations. The species are those that are common to the Material Management Policy, revised Decommissioning Policy and the Ambient Air Quality Criteria List and for which pertinent physical and chemical data are available.

The meaning of the column headings in Tables B3 and B4 are:

1.	CHEMICALS	chemical name used in the AAQC list.
2.	AQ_NO	position of the species in the AAQC list.
3.	HTS (M)	height in meters at which the modelling concentration is given.
4.	XP (M)	downwind location (from upwind edge of the source) at which the maximum concentration at a particular level occurs.
5.	MASS FRAC. MODEL	mass fraction used in the model. In the case with no resistance, a pure liquid pool is assumed and the mass fraction is 1. In the case with soil resistance, the model would reset the mass fraction to that allowed by the solubility limit of the species in water if the initial mass fraction violates the solubility limit.
6.	MAX CONC.	maximum concentration anywhere in the domain (the position indicated in column 4 in ug/m^3.
7.	1/2 HR AQC	half-hour standard for the species according to the AAQC (ug/m^3)
8.	1/2 HR SOIL CONC. (PPMM)	maximum concentration of the chemical in soil that would not produce an ambient concentration exceeding the AAQC standard in parts per million by mass. A bulk soil density of 1.3 g/m^3 is assumed.
9.	24 HR AQC	same as 7 but for 24 hr. period.
10.	24 HR SOIL CONC. (PPMM)*	same as 8 but for 24 hr. period.

* A mass proration is applied in converting from mass fraction in water (result of model) to mass fraction in soil. This implicitly assumes that the molecular weights of water and soil are identical, otherwise a mole ratio should be used. However, given the difficulty in determining the molecular weight of soil, and the fact that soil can be moist with water, it is believed to be a justifiable assumption leading to a small inaccuracy as compared to other errors.

Table B1. Summary of Runs made for the case with no soil resistance.

Run No.	Source Dimensions x=y (m)	Roughness Lenght over Source (m)	Friction Velocity (m/s)
1	10 x 10	0.05	0.1
2	10 x 10	0.10	0.1
3	10 x 10	0.20	0.1
4	10 x 10	0.05	0.2
5	10 x 10	0.10	0.2
6	10 x 10	0.20	0.2
7	50 x 50	0.05	0.1
8	50 x 50	0.10	0.1
9	50 x 50	0.20	0.1
10	50 x 50	0.05	0.2
11	50 x 50	0.10	0.2
12	50 x 50	0.20	0.2
13	100 x 100	0.05	0.1
14	100 x 100	0.10	0.1
15	100 x 100	0.20	0.1
16	100 x 100	0.05	0.2
17	100 x 100	0.10	0.2
18	100 x 100	0.20	0.2

Table B2. Summary of runs made for the case with soil resistance.

Run No.	Source Dimension (m)	Waste Bed Thickness (m)	Cap Thickness (m)	Porosity of Waste	Porosity of Soil	Barometric Pump (yes/no)
1	100 x 100	10	3	0.5	0.5	Y
2	100 x 100	10	1	0.5	0.3	Y
3	100 x 100	10	1	0.5	0.5	Y
4	100 x 100	10	1	0.5	0.5	N
5	100 x 100	10	1	0.5	0.6	Y
6	10 x 10	1	1	0.5	0.5	Y
7	10 x 10	1	1	0.5	0.5	N
8	10 x 10	1	0.5	0.5	0.5	Y
9	100 x 100	10	0.5	0.5	0.5	Y
10	100 x 100	5	1	0.5	0.5	Y

Table B3.1 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.050
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	45.0	0.100E+01	0.504E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	25.0		0.842E+07		-0.999E+01		-0.999E+01
		1.0	15.0		0.155E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.339E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	45.0	0.100E+01	0.225E+07	0.200E+04	0.356E+04	0.200E+04	0.356E+04
		1.5	25.0		0.376E+07		0.214E+04		0.214E+04
		1.0	15.0		0.691E+07		0.116E+04		0.116E+04
		0.5	15.0		0.151E+08		0.532E+03		0.532E+03
Ethylbenzene	119	2.0	45.0	0.100E+01	0.936E+06	0.400E+04	0.190E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.156E+07		0.115E+05		-0.999E+01
		1.0	15.0		0.287E+07		0.628E+04		-0.999E+01
		0.5	15.0		0.629E+07		0.288E+04		-0.999E+01
Styrene	276	2.0	45.0	0.100E+01	0.685E+06	0.400E+03	0.259E+04	0.400E+03	0.259E+04
		1.5	25.0		0.114E+07		0.155E+04		0.155E+04
		1.0	15.0		0.210E+07		0.846E+03		0.846E+03
		0.5	15.0		0.460E+07		0.387E+03		0.387E+03
Napthalene	213	2.0	45.0	0.100E+01	0.123E+05	0.360E+02	0.158E+05	0.225E+02	0.992E+04
		1.5	25.0		0.205E+05		0.952E+04		0.598E+04
		1.0	15.0		0.377E+05		0.521E+04		0.326E+04
		0.5	15.0		0.825E+09		0.238E+04		0.149E+04
Chloromethane	191	2.0	45.0	0.100E+01	0.659E+08	0.200E+05	0.654E+03	0.700E+04	0.229E+03
		1.5	25.0		0.111E+09		0.390E+03		0.137E+03
		1.0	15.0		0.204E+09		0.212E+03		0.741E+02
		0.5	15.0		0.444E+09		0.972E+02		0.340E+02
Bromomethane	190	2.0	45.0	0.100E+01	0.377E+08	0.400E+04	0.430E+03	0.135E+04	0.145E+03
		1.5	25.0		0.631E+08		0.257E+03		0.868E+02
		1.0	15.0		0.116E+09		0.140E+03		0.471E+02
		0.5	15.0		0.254E+09		0.640E+02		0.216E+02
Carbon tetrachloride	54	2.0	45.0	0.100E+01	0.330E+07	0.180E+04	0.357E+04	0.600E+03	0.119E+04
		1.5	25.0		0.551E+07		0.214E+04		0.715E+03
		1.0	15.0		0.101E+08		0.117E+04		0.389E+03
		0.5	15.0		0.222E+08		0.534E+03		0.178E+03
1,2-Dichlorethane	125	2.0	45.0	0.100E+01	0.157E+07	0.120E+04	0.321E+04	0.400E+03	0.107E+04
		1.5	25.0		0.263E+07		0.193E+04		0.643E+03
		1.0	15.0		0.484E+07		0.105E+04		0.349E+03
		0.5	15.0		0.106E+08		0.479E+03		0.160E+03
1,1-Dichloroethylene	306	2.0	45.0	0.100E+01	0.534E+08	0.700E+02	0.541E+01	0.350E+02	0.270E+01
		1.5	25.0		0.893E+08		0.323E+01		0.162E+01
		1.0	15.0		0.164E+09		0.176E+01		0.878E+00
		0.5	15.0		0.359E+09		0.304E+00		0.402E+00
Trichloroethylene	296	2.0	45.0	0.100E+01	0.631E+07	0.850E+05	0.527E+05	0.280E+05	0.180E+05
		1.5	25.0		0.105E+08		0.323E+05		0.109E+05
		1.0	15.0		0.194E+08		0.178E+05		0.594E+04
		0.5	15.0		0.424E+08		0.823E+04		0.273E+04
1,2-Dichloropropane	256	2.0	45.0	0.100E+01	0.439E+07	0.240E+04	0.226E+04	0.240E+04	0.226E+04
		1.5	25.0		0.734E+07		0.135E+04		0.135E+04
		1.0	15.0		0.135E+08		0.736E+03		0.736E+03
		0.5	15.0		0.295E+08		0.337E+03		0.337E+03
Tetracloroethylene	235	2.0	45.0	0.100E+01	0.184E+07	0.100E+05	0.255E+05	0.400E+04	0.104E+05
		1.5	25.0		0.307E+07		0.154E+05		0.624E+05
		1.0	15.0		0.566E+07		0.346E+04		0.340E+04
		0.5	15.0		0.124E+08		0.389E+04		0.156E+04
Chlorobenzene	211	2.0	45.0	0.100E+01	0.145E+07	0.420E+04	0.167E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.243E+07		0.100E+05		-0.999E+01
		1.0	15.0		0.446E+07		0.549E+04		-0.999E+01
		0.5	15.0		0.976E+07		0.252E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	45.0	0.100E+01	0.136E+06	0.370E+05	0.538E+06	-0.100E+04	-0.999E+01
		1.5	25.0		0.227E+06		0.422E+06		-0.999E+01
		1.0	15.0		0.413E+06		0.291E+06		-0.999E+01
		0.5	15.0		0.915E+06		0.160E+06		-0.999E+01

Table B3.2 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	35.0	0.100E+01	0.632E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	25.0		0.106E+08		-0.999E+01		-0.999E+01
		1.0	15.0		0.197E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.372E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	35.0	0.100E+01	0.282E+07	0.200E+04	0.284E+04	0.200E+04	0.284E+04
		1.5	25.0		0.474E+07		0.169E+04		0.169E+04
		1.0	15.0		0.878E+07		0.915E+03		0.915E+03
		0.5	15.0		0.166E+08		0.484E+03		0.484E+03
Ethylbenzene	119	2.0	35.0	0.100E+01	0.117E+07	0.400E+04	0.152E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.197E+07		0.911E+04		-0.999E+01
		1.0	15.0		0.365E+07		0.494E+04		-0.999E+01
		0.5	15.0		0.692E+07		0.262E+04		-0.999E+01
Styrene	276	2.0	35.0	0.100E+01	0.859E+06	0.400E+03	0.207E+04	0.400E+03	0.207E+04
		1.5	25.0		0.144E+07		0.123E+04		0.123E+04
		1.0	15.0		0.267E+07		0.665E+03		0.665E+03
		0.5	15.0		0.506E+07		0.352E+03		0.352E+03
Napthalene	213	2.0	35.0	0.100E+01	0.154E+05	0.360E+02	0.126E+05	0.225E+02	0.793E+04
		1.5	25.0		0.259E+05		0.756E+04		0.474E+04
		1.0	15.0		0.479E+05		0.410E+04		0.257E+04
		0.5	15.0		0.908E+05		0.217E+04		0.136E+04
Chloromethane	191	2.0	35.0	0.100E+01	0.826E+08	0.200E+05	0.522E+03	0.700E+04	0.183E+03
		1.5	25.0		0.139E+09		0.310E+03		0.109E+03
		1.0	15.0		0.258E+09		0.167E+03		0.584E+02
		0.5	15.0		0.487E+09		0.886E+02		0.310E+02
Bromomethane	190	2.0	35.0	0.100E+01	0.473E+08	0.400E+04	0.343E+03	0.135E+04	0.116E+03
		1.5	25.0		0.795E+08		0.204E+03		0.689E+02
		1.0	15.0		0.147E+09		0.110E+03		0.371E+02
		0.5	15.0		0.278E+09		0.583E+02		0.197E+02
Carbon tetrachloride	54	2.0	35.0	0.100E+01	0.414E+07	0.180E+04	0.285E+04	0.600E+03	0.953E+03
		1.5	25.0		0.695E+07		0.170E+04		0.567E+03
		1.0	15.0		0.129E+08		0.917E+03		0.306E+03
		0.5	15.0		0.244E+08		0.485E+03		0.162E+03
1,2-Dichlorethane	125	2.0	35.0	0.100E+01	0.197E+07	0.120E+04	0.257E+04	0.400E+03	0.857E+03
		1.5	25.0		0.332E+07		0.153E+04		0.510E+03
		1.0	15.0		0.615E+07		0.824E+03		0.275E+03
		0.5	15.0		0.116E+08		0.436E+03		0.146E+03
1,1-Dichloroethylene	306	2.0	35.0	0.100E+01	0.670E+08	0.700E+02	0.431E+01	0.350E+02	0.216E+01
		1.5	25.0		0.113E+09		0.256E+01		0.128E+01
		1.0	15.0		0.209E+09		0.138E+01		0.691E+00
		0.5	15.0		0.394E+09		0.732E+00		0.466E+00
Trichloroethylene	296	2.0	35.0	0.100E+01	0.791E+07	0.850E+05	0.425E+05	0.280E+05	0.144E+05
		1.5	25.0		0.133E+08		0.258E+05		0.864E+04
		1.0	15.0		0.209E+08		0.141E+05		0.468E+04
		0.5	15.0		0.394E+08		0.750E+04		0.248E+04
1,2-Dichloropropane	256	2.0	35.0	0.100E+01	0.551E+07	0.240E+04	0.180E+04	0.240E+04	0.180E+04
		1.5	25.0		0.926E+07		0.107E+04		0.107E+04
		1.0	15.0		0.173E+08		0.579E+03		0.579E+03
		0.5	15.0		0.324E+08		0.306E+03		0.306E+03
Tetracloroethylene	235	2.0	35.0	0.100E+01	0.231E+07	0.100E+05	0.205E+05	0.400E+04	0.829E+04
		1.5	25.0		0.388E+07		0.123E+05		0.495E+04
		1.0	15.0		0.719E+07		0.667E+04		0.268E+04
		0.5	15.0		0.136E+08		0.354E+04		0.142E+04
Chlorobenzene	211	2.0	35.0	0.100E+01	0.182E+07	0.420E+04	0.133E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.306E+07		0.798E+04		-0.999E+01
		1.0	15.0		0.567E+07		0.433E+04		-0.999E+01
		0.5	15.0		0.107E+07		0.229E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	35.0	0.100E+01	0.171E+06	0.370E+05	0.487E+06	-0.100E+04	-0.999E+01
		1.5	25.0		0.287E+06		0.370E+06		-0.999E+01
		1.0	15.0		0.532E+06		0.245E+06		-0.999E+01
		0.5	15.0		0.101E+07		0.148E+06		-0.999E+01

Table B3.3 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	25.0	0.100E+01	0.801E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	15.0		0.134E+08		-0.999E+01		-0.999E+01
		1.0	15.0		0.244E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.401E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	25.0	0.100E+01	0.357E+07	0.200E+04	0.225E+04	0.200E+04	0.225E+04
		1.5	15.0		0.598E+07		0.134E+04		0.134E+04
		1.0	15.0		0.109E+08		0.737E+03		0.737E+03
		0.5	15.0		0.179E+08		0.449E+03		0.449E+03
Ethylbenzene	119	2.0	25.0	0.100E+01	0.149E+07	0.400E+04	0.121E+05	-0.100E+04	-0.999E+01
		1.5	15.0		0.249E+07		0.724E+04		-0.999E+01
		1.0	15.0		0.454E+07		0.398E+04		-0.999E+01
		0.5	15.0		0.745E+07		0.243E+04		-0.999E+01
Styrene	276	2.0	25.0	0.100E+01	0.109E+07	0.400E+03	0.163E+04	0.400E+03	0.163E+04
		1.5	15.0		0.182E+07		0.977E+03		0.977E+03
		1.0	15.0		0.332E+07		0.536E+03		0.536E+03
		0.5	15.0		0.545E+07		0.326E+03		0.326E+03
Napthalene	213	2.0	25.0	0.100E+01	0.195E+05	0.360E+02	0.999E+04	0.225E+02	0.627E+04
		1.5	15.0		0.326E+05		0.600E+04		0.376E+04
		1.0	15.0		0.595E+05		0.330E+04		0.207E+04
		0.5	15.0		0.979E+05		0.201E+04		0.126E+04
Chloromethane	191	2.0	25.0	0.100E+01	0.105E+09	0.200E+05	0.412E+03	0.700E+04	0.144E+03
		1.5	15.0		0.176E+09		0.246E+03		0.860E+02
		1.0	15.0		0.320E+09		0.135E+03		0.472E+02
		0.5	15.0		0.522E+09		0.826E+02		0.289E+02
Bromomethane	190	2.0	25.0	0.100E+01	0.599E+08	0.400E+04	0.271E+03	0.135E+04	0.915E+02
		1.5	15.0		0.100E+09		0.162E+03		0.546E+02
		1.0	15.0		0.183E+09		0.888E+02		0.300E+02
		0.5	15.0		0.299E+09		0.542E+02		0.183E+02
Carbon tetrachloride	54	2.0	25.0	0.100E+01	0.524E+07	0.180E+04	0.225E+04	0.600E+03	0.725E+03
		1.5	15.0		0.877E+07		0.135E+04		0.450E+03
		1.0	15.0		0.160E+08		0.740E+03		0.247E+03
		0.5	15.0		0.262E+08		0.451E+03		0.150E+03
1,2-Dichlorethane	125	2.0	25.0	0.100E+01	0.250E+07	0.120E+04	0.203E+04	0.400E+03	0.676E+03
		1.5	15.0		0.418E+07		0.121E+04		0.404E+03
		1.0	15.0		0.763E+07		0.665E+03		0.222E+03
		0.5	15.0		0.125E+08		0.406E+03		0.135E+03
1,1-Dichloroethylene	306	2.0	25.0	0.100E+01	0.848E+08	0.700E+02	0.340E+01	0.350E+02	0.170E+01
		1.5	15.0		0.142E+09		0.203E+01		0.102E+01
		1.0	15.0		0.259E+09		0.111E+01		0.557E+00
		0.5	15.0		0.424E+09		0.680E+00		0.340E+00
Trichloroethylene	296	2.0	25.0	0.100E+01	0.100E+08	0.850E+05	0.339E+05	0.280E+05	0.114E+05
		1.5	15.0		0.168E+08		0.205E+05		0.687E+04
		1.0	15.0		0.306E+08		0.114E+05		0.378E+04
		0.5	15.0		0.510E+08		0.697E+04		0.231E+04
1,2-Dichloropropane	256	2.0	25.0	0.100E+01	0.697E+07	0.240E+04	0.142E+04	0.240E+04	0.142E+04
		1.5	15.0		0.117E+08		0.851E+03		0.851E+03
		1.0	15.0		0.213E+08		0.467E+03		0.467E+03
		0.5	15.0		0.349E+08		0.285E+03		0.285E+03
Tetracloroethylene	235	2.0	25.0	0.100E+01	0.292E+07	0.100E+05	0.162E+05	0.400E+04	0.656E+04
		1.5	15.0		0.489E+07		0.977E+04		0.393E+04
		1.0	15.0		0.892E+07		0.538E+04		0.216E+04
		0.5	15.0		0.146E+08		0.329E+04		0.132E+04
Chlorobenzene	211	2.0	25.0	0.100E+01	0.231E+07	0.420E+04	0.106E+05	-0.100E+04	-0.999E+01
		1.5	15.0		0.386E+07		0.634E+04		-0.999E+01
		1.0	15.0		0.704E+07		0.349E+04		-0.999E+01
		0.5	15.0		0.116E+08		0.213E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	25.0	0.100E+01	0.216E+06	0.370E+05	0.433E+06	-0.100E+04	-0.999E+01
		1.5	15.0		0.362E+06		0.320E+06		-0.999E+01
		1.0	15.0		0.660E+06		0.208E+06		-0.999E+01
		0.5	15.0		0.108E+07		0.139E+06		-0.999E+01

Table B3.4 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.50
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	25.0	0.100E+01	0.509E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	25.0		0.801E+07		-0.999E+01		-0.999E+01
		1.0	15.0		0.146E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.282E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	25.0	0.100E+01	0.227E+07	0.200E+04	0.353E+04	0.200E+04	0.353E+04
		1.5	25.0		0.357E+07		0.225E+04		0.225E+04
		1.0	15.0		0.651E+07		0.123E+04		0.123E+04
		0.5	15.0		0.126E+08		0.639E+03		0.639E+03
Ethylbenzene	119	2.0	25.0	0.100E+01	0.944E+06	0.400E+04	0.188E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.149E+07		0.121E+05		-0.999E+01
		1.0	15.0		0.271E+07		0.666E+04		-0.999E+01
		0.5	15.0		0.523E+07		0.346E+04		-0.999E+01
Styrene	276	2.0	25.0	0.100E+01	0.691E+06	0.400E+03	0.257E+04	0.400E+03	0.257E+04
		1.5	25.0		0.109E+07		0.163E+04		0.163E+04
		1.0	15.0		0.198E+07		0.898E+03		0.898E+03
		0.5	15.0		0.383E+07		0.456E+03		0.465E+03
Napthalene	213	2.0	25.0	0.100E+01	0.124E+05	0.360E+02	0.156E+05	0.225E+02	0.984E+04
		1.5	25.0		0.195E+05		0.100E+05		0.628E+04
		1.0	15.0		0.355E+05		0.552E+04		0.346E+04
		0.5	15.0		0.687E+05		0.286E+04		0.465E+04
Chloromethane	191	2.0	25.0	0.100E+01	0.666E+08	0.200E+05	0.647E+03	0.700E+04	0.227E+03
		1.5	25.0		0.105E+09		0.412E+03		0.144E+03
		1.0	15.0		0.191E+09		0.226E+03		0.789E+02
		0.5	15.0		0.369E+09		0.117E+03		0.410E+02
Bromomethane	190	2.0	25.0	0.100E+01	0.482E+08	0.400E+04	0.426E+03	0.135E+04	0.144E+03
		1.5	25.0		0.599E+08		0.271E+03		0.915E+02
		1.0	15.0		0.209E+09		0.149E+03		0.501E+02
		0.5	15.0		0.222E+09		0.770E+02		0.260E+02
Carbon tetrachloride	54	2.0	25.0	0.100E+01	0.333E+07	0.180E+04	0.354E+04	0.600E+03	0.118E+04
		1.5	25.0		0.524E+07		0.225E+04		0.752E+03
		1.0	15.0		0.955E+07		0.124E+04		0.413E+03
		0.5	15.0		0.184E+08		0.641E+03		0.214E+03
1,2-Dichlorethane	125	2.0	25.0	0.100E+01	0.159E+07	0.120E+04	0.318E+04	0.400E+03	0.106E+04
		1.5	25.0		0.250E+07		0.203E+04		0.676E+03
		1.0	15.0		0.456E+07		0.111E+03		0.371E+03
		0.5	15.0		0.880E+07		0.576E+03		0.192E+03
1,1-Dichloroethylene	306	2.0	25.0	0.100E+01	0.539E+08	0.700E+02	0.535E+01	0.350E+02	0.268E+01
		1.5	25.0		0.848E+08		0.340E+01		0.170E+01
		1.0	15.0		0.255E+09		0.187E+01		0.933E+00
		0.5	15.0		0.299E+09		0.967E+00		0.483E+00
Trichloroethylene	296	2.0	25.0	0.100E+01	0.637E+07	0.850E+05	0.522E+05	0.280E+05	0.179E+05
		1.5	25.0		0.100E+08		0.339E+05		0.114E+05
		1.0	15.0		0.183E+08		0.189E+05		0.631E+04
		0.5	15.0		0.353E+08		0.988E+04		0.328E+04
1,2-Dichloropropane	256	2.0	25.0	0.100E+01	0.443E+07	0.240E+04	0.224E+04	0.240E+04	0.224E+04
		1.5	25.0		0.697E+07		0.142E+04		0.142E+03
		1.0	15.0		0.127E+08		0.781E+03		0.781E+03
		0.5	15.0		0.246E+08		0.405E+03		0.405E+03
Tetracloroethylene	235	2.0	25.0	0.100E+01	0.186E+07	0.100E+05	0.253E+05	0.400E+04	0.103E+05
		1.5	25.0		0.292E+07		0.162E+05		0.656E+04
		1.0	15.0		0.533E+07		0.898E+04		0.361E+04
		0.5	15.0		0.103E+08		0.467E+04		0.187E+04
Chlorobenzene	211	2.0	25.0	0.100E+01	0.147E+07	0.420E+04	0.165E+05	-0.100E+04	-0.999E+01
		1.5	25.0		0.231E+07		0.106E+05		-0.999E+01
		1.0	15.0		0.420E+07		0.583E+04		-0.999E+01
		0.5	15.0		0.812E+07		0.302E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	25.0	0.100E+01	0.137E+06	0.370E+05	0.536E+06	-0.100E+04	-0.999E+01
		1.5	25.0		0.216E+06		0.433E+06		-0.999E+01
		1.0	15.0		0.394E+06		0.302E+06		-0.999E+01
		0.5	15.0		0.762E+06		0.186E+06		-0.999E+01

Table B3.5 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	25.0	0.100E+01	0.648E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	15.0		0.105E+08		-0.999E+01		-0.999E+01
		1.0	15.0		0.179E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.303E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	25.0	0.100E+01	0.289E+07	0.200E+04	0.273E+04	0.200E+04	0.278E+04
		1.5	15.0		0.470E+07		0.171E+04		0.171E+04
		1.0	15.0		0.797E+07		0.101E+04		0.101E+04
		0.5	15.0		0.135E+08		0.594E+03		0.594E+03
Ethylbenzene	119	2.0	25.0	0.100E+01	0.120E+07	0.400E+04	0.149E+05	-0.100E+04	-0.999E+01
		1.5	15.0		0.195E+07		0.919E+05		-0.999E+01
		1.0	15.0		0.332E+07		0.544E+04		-0.999E+01
		0.5	15.0		0.564E+07		0.321E+04		-0.999E+01
Styrene	276	2.0	25.0	0.100E+01	0.880E+06	0.400E+03	0.202E+04	0.400E+03	0.202E+04
		1.5	15.0		0.143E+07		0.124E+04		0.124E+04
		1.0	15.0		0.243E+07		0.733E+03		0.733E+03
		0.5	15.0		0.413E+07		0.431E+03		0.431E+03
Napthalene	213	2.0	25.0	0.100E+01	0.158E+05	0.360E+02	0.123E+05	0.225E+02	0.774E+04
		1.5	15.0		0.256E+05		0.762E+04		0.478E+04
		1.0	15.0		0.435E+05		0.451E+04		0.282E+04
		0.5	15.0		0.740E+05		0.266E+04		0.166E+04
Chloromethane	191	2.0	25.0	0.100E+01	0.846E+08	0.200E+05	0.510E+03	0.700E+04	0.178E+03
		1.5	15.0		0.138E+09		0.313E+03		0.109E+03
		1.0	15.0		0.234E+09		0.185E+03		0.646E+02
		0.5	15.0		0.396E+09		0.109E+03		0.382E+02
Bromomethane	190	2.0	25.0	0.100E+01	0.484E+08	0.400E+04	0.335E+03	0.135E+04	0.113E+03
		1.5	15.0		0.788E+08		0.206E+03		0.695E+02
		1.0	15.0		0.134E+09		0.121E+03		0.410E+02
		0.5	15.0		0.227E+09		0.716E+02		0.242E+02
Carbon tetrachloride	54	2.0	25.0	0.100E+01	0.424E+07	0.180E+04	0.278E+04	0.600E+03	0.930E+03
		1.5	15.0		0.689E+07		0.171E+04		0.572E+03
		1.0	15.0		0.117E+08		0.101E+04		0.337E+03
		0.5	15.0		0.199E+08		0.596E+03		0.199E+03
1,2-Dichlorethane	125	2.0	25.0	0.100E+01	0.202E+07	0.120E+04	0.250E+04	0.400E+03	0.836E+03
		1.5	15.0		0.329E+07		0.154E+04		0.514E+03
		1.0	15.0		0.558E+07		0.909E+03		0.303E+03
		0.5	15.0		0.947E+07		0.536E+03		0.179E+03
1,1-Dichloroethylene	306	2.0	25.0	0.100E+01	0.686E+08	0.700E+02	0.421E+01	0.350E+02	0.210E+01
		1.5	15.0		0.112E+09		0.259E+01		0.129E+01
		1.0	15.0		0.189E+09		0.153E+01		0.763E+00
		0.5	15.0		0.321E+09		0.899E+00		0.449E+00
Trichloroethylene	296	2.0	25.0	0.100E+01	0.810E+07	0.850E+05	0.415E+05	0.280E+05	0.141E+05
		1.5	15.0		0.132E+08		0.260E+05		0.872E+04
		1.0	15.0		0.224E+08		0.155E+05		0.516E+04
		0.5	15.0		0.380E+08		0.919E+04		0.305E+04
1,2-Dichloropropane	256	2.0	25.0	0.100E+01	0.564E+07	0.240E+04	0.176E+04	0.240E+04	0.176E+04
		1.5	15.0		0.918E+07		0.108E+04		0.108E+04
		1.0	15.0		0.156E+08		0.638E+03		0.638E+03
		0.5	15.0		0.264E+08		0.376E+03		0.376E+03
Tetracloroethylene	235	2.0	25.0	0.100E+01	0.236E+07	0.100E+05	0.200E+05	0.400E+04	0.810E+04
		1.5	15.0		0.385E+07		0.124E+05		0.499E+04
		1.0	15.0		0.652E+07		0.734E+04		0.295E+04
		0.5	15.0		0.111E+08		0.434E+04		0.174E+04
Chlorobenzene	211	2.0	25.0	0.100E+01	0.187E+07	0.420E+04	0.130E+05	-0.100E+04	-0.999E+01
		1.5	15.0		0.304E+07		0.805E+04		-0.999E+01
		1.0	15.0		0.515E+07		0.476E+04		-0.999E+01
		0.5	15.0		0.875E+07		0.281E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	25.0	0.100E+01	0.175E+06	0.370E+05	0.482E+06	-0.100E+04	-0.999E+01
		1.5	15.0		0.285E+06		0.372E+06		-0.999E+01
		1.0	15.0		0.483E+06		0.263E+06		-0.999E+01
		0.5	15.0		0.821E+06		0.175E+06		-0.999E+01

Table B3.6 Summary table without soil resistance.

SOURCE DIMENSION (M) = 10 X 10
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	15.0	0.100E+01	0.858E+07	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	15.0		0.139E+08		-0.999E+01		-0.999E+01
		1.0	15.0		0.213E+08		-0.999E+01		-0.999E+01
		0.5	15.0		0.319E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	15.0	0.100E+01	0.383E+07	0.200E+04	0.210E+04	0.200E+04	0.210E+04
		1.5	15.0		0.618E+07		0.130E+04		0.130E+04
		1.0	15.0		0.951E+07		0.846E+03		0.846E+03
		0.5	15.0		0.142E+08		0.565E+03		0.565E+03
Ethylbenzene	119	2.0	15.0	0.100E+01	0.159E+07	0.400E+04	0.113E+05	-0.100E+04	-0.999E+01
		1.5	15.0		0.257E+07		0.700E+04		-0.999E+01
		1.0	15.0		0.396E+07		0.456E+04		-0.999E+01
		0.5	15.0		0.593E+07		0.305E+04		-0.999E+01
Styrene	276	2.0	15.0	0.100E+01	0.117E+07	0.400E+03	0.152E+04	0.400E+03	0.152E+04
		1.5	15.0		0.188E+07		0.945E+03		0.945E+03
		1.0	15.0		0.290E+07		0.614E+03		0.614E+03
		0.5	15.0		0.434E+07		0.410E+03		0.410E+03
Napthalene	213	2.0	15.0	0.100E+01	0.209E+05	0.360E+02	0.933E+04	0.225E+02	0.586E+04
		1.5	15.0		0.338E+05		0.580E+04		0.364E+04
		1.0	15.0		0.519E+05		0.378E+04		0.237E+04
		0.5	15.0		0.778E+05		0.253E+04		0.158E+04
Chloromethane	191	2.0	15.0	0.100E+01	0.112E+09	0.200E+05	0.384E+03	0.700E+04	0.135E+03
		1.5	15.0		0.181E+09		0.238E+03		0.834E+02
		1.0	15.0		0.278E+09		0.155E+03		0.543E+02
		0.5	15.0		0.415E+09		0.104E+03		0.364E+02
Bromomethane	190	2.0	15.0	0.100E+01	0.642E+08	0.400E+04	0.253E+03	0.135E+04	0.853E+02
		1.5	15.0		0.104E+09		0.157E+03		0.529E+02
		1.0	15.0		0.159E+09		0.102E+03		0.344E+02
		0.5	15.0		0.238E+09		0.682E+02		0.230E+02
Carbon tetrachloride	54	2.0	15.0	0.100E+01	0.561E+07	0.180E+04	0.210E+04	0.600E+03	0.702E+03
		1.5	15.0		0.906E+07		0.130E+04		0.435E+03
		1.0	15.0		0.139E+08		0.848E+03		0.283E+03
		0.5	15.0		0.209E+08		0.567E+03		0.189E+03
1,2-Dichlorethane	125	2.0	15.0	0.100E+01	0.268E+07	0.120E+04	0.189E+04	0.400E+03	0.631E+03
		1.5	15.0		0.432E+07		0.117E+04		0.391E+03
		1.0	15.0		0.665E+07		0.763E+03		0.254E+03
		0.5	15.0		0.994E+07		0.510E+03		0.170E+03
1,1-Dichloroethylene	306	2.0	15.0	0.100E+01	0.909E+08	0.700E+02	0.317E+01	0.350E+02	0.159E+01
		1.5	15.0		0.147E+09		0.197E+01		0.984E+00
		1.0	15.0		0.226E+09		0.128E+01		0.640E+00
		0.5	15.0		0.337E+09		0.856E+00		0.428E+00
Trichloroethylene	296	2.0	15.0	0.100E+01	0.107E+08	0.850E+05	0.317E+05	0.280E+05	0.107E+05
		1.5	15.0		0.173E+08		0.199E+05		0.664E+04
		1.0	15.0		0.266E+08		0.130E+05		0.433E+04
		0.5	15.0		0.399E+08		0.875E+04		0.290E+04
1,2-Dichloropropane	256	2.0	15.0	0.100E+01	0.748E+07	0.240E+04	0.133E+04	0.240E+04	0.133E+04
		1.5	15.0		0.121E+08		0.823E+03		0.823E+03
		1.0	15.0		0.186E+08		0.536E+03		0.536E+03
		0.5	15.0		0.278E+08		0.358E+03		0.358E+03
Tetracloroethylene	235	2.0	15.0	0.100E+01	0.313E+07	0.100E+05	0.152E+05	0.400E+04	0.612E+04
		1.5	15.0		0.506E+07		0.945E+04		0.380E+04
		1.0	15.0		0.778E+07		0.617E+04		0.248E+04
		0.5	15.0		0.116E+08		0.413E+04		0.166E+04
Chlorobenzene	211	2.0	15.0	0.100E+01	0.247E+07	0.420E+04	0.986E+04	-0.100E+04	-0.999E+01
		1.5	15.0		0.399E+07		0.613E+04		-0.999E+01
		1.0	15.0		0.614E+07		0.400E+04		-0.999E+01
		0.5	15.0		0.920E+07		0.267E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	15.0	0.100E+01	0.232E+06	0.370E+05	0.418E+06	-0.100E+04	-0.999E+01
		1.5	15.0		0.374E+06		0.313E+06		-0.999E+01
		1.0	15.0		0.576E+06		0.231E+06		-0.999E+01
		0.5	15.0		0.863E+06		0 168E+06		-0.999E+01

Table B3.7 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.50
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	65.0	0.100E+01	0.240E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.382E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.583E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.848E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	65.0	0.100E+01	0.107E+08	0.200E+04	0.749E+03	0.200E+04	0.749E+03
		1.5	55.0		0.171E+08		0.471E+03		0.471E+03
		1.0	55.0		0.260E+08		0.309E+03		0.309E+03
		0.5	55.0		0.379E+08		0.212E+03		0.212E+03
Ethylbenzene	119	2.0	65.0	0.100E+01	0.446E+07	0.400E+04	0.405E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.710E+07		0.255E+04		-0.999E+01
		1.0	55.0		0.108E+08		0.167E+04		-0.999E+01
		0.5	55.0		0.158E+08		0.115E+04		-0.999E+01
Styrene	276	2.0	65.0	0.100E+01	0.327E+07	0.400E+03	0.544E+03	0.400E+03	0.544E+03
		1.5	55.0		0.520E+07		0.342E+03		0.342E+03
		1.0	55.0		0.793E+07		0.225E+03		0.225E+03
		0.5	55.0		0.115E+08		0.154E+03		0.154E+03
Napthalene	213	2.0	65.0	0.100E+01	0.586E+05	0.360E+02	0.335E+04	0.225E+02	0.210E+04
		1.5	55.0		0.932E+05		0.211E+04		0.132E+04
		1.0	55.0		0.142E+06		0.138E+04		0.866E+03
		0.5	55.0		0.207E+06		0.951E+03		0.595E+03
Chloromethane	191	2.0	65.0	0.100E+01	0.314E+09	0.200E+05	0.137E+03	0.700E+04	0.480E+02
		1.5	55.0		0.500E+09		0.863E+02		0.302E+02
		1.0	55.0		0.761E+09		0.567E+02		0.198E+02
		0.5	55.0		0.110E+10		0.391E+02		0.137E+02
Bromomethane	190	2.0	65.0	0.100E+01	0.180E+09	0.400E+04	0.903E+02	0.135E+04	0.305E+02
		1.5	55.0		0.286E+09		0.568E+02		0.192E+02
		1.0	55.0		0.436E+09		0.373E+02		0.126E+02
		0.5	55.0		0.632E+09		0.257E+02		0.866E+02
Carbon tetrachloride	54	2.0	65.0	0.100E+01	0.157E+08	0.180E+04	0.752E+03	0.600E+03	0.251E+03
		1.5	55.0		0.250E+08		0.473E+03		0.158E+03
		1.0	55.0		0.381E+08		0.310E+03		0.103E+03
		0.5	55.0		0.555E+08		0.213E+03		0.711E+02
1,2-Dichlorethane	125	2.0	65.0	0.100E+01	0.750E+07	0.120E+04	0.676E+03	0.400E+03	0.225E+03
		1.5	55.0		0.119E+08		0.425E+03		0.142E+03
		1.0	55.0		0.182E+08		0.279E+03		0.930E+02
		0.5	55.0		0.264E+08		0.192E+03		0.640E+02
1,1-Dichloroethylene	306	2.0	65.0	0.100E+01	0.255E+09	0.700E+02	0.113E+01	0.350E+02	0.567E+00
		1.5	55.0		0.405E+09		0.713E+00		0.356E+00
		1.0	55.0		0.617E+09		0.468E+00		0.234E+00
		0.5	55.0		0.897E+09		0.322E+00		0.161E+00
Trichloroethylene	296	2.0	65.0	0.100E+01	0.301E+08	0.850E+05	0.116E+05	0.280E+05	0.384E+04
		1.5	55.0		0.478E+08		0.730E+04		0.242E+04
		1.0	55.0		0.729E+08		0.480E+04		0.159E+04
		0.5	55.0		0.106E+08		0.331E+04		0.109E+04
1,2-Dichloropropane	256	2.0	65.0	0.100E+01	0.209E+08	0.240E+04	0.464E+03	0.240E+04	0.474E+03
		1.5	55.0		0.333E+08		0.298E+03		0.298E+03
		1.0	55.0		0.508E+08		0.196E+03		0.198E+03
		0.5	55.0		0.738E+08		0.135E+03		0.135E+03
Tetracloroethylene	235	2.0	65.0	0.100E+01	0.878E+07	0.100E+05	0.547E+04	0.400E+04	0.219E+04
		1.5	55.0		0.140E+08		0.345E+04		0.138E+04
		1.0	55.0		0.213E+08		0.226E+04		0.906E+03
		0.5	55.0		0.310E+08		0.156E+04		0.623E+03
Chlorobenzene	211	2.0	65.0	0.100E+01	0.693E+07	0.420E+04	0.354E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.110E+08		0.223E+04		-0.999E+01
		1.0	55.0		0.168E+08		0.146E+04		-0.999E+01
		0.5	55.0		0.245E+08		0.101E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	65.0	0.100E+01	0.650E+06	0.370E+05	0.211E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.103E+07		0.145E+06		-0.999E+01
		1.0	55.0		0.158E+07		0.101E+06		-0.999E+01
		0.5	55.0		0.230E+07		0.715E+05		-0.999E+01

Table B3.8 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC (UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	55.0	0.100E+01	0.291E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.452E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.647E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.871E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	55.0	0.100E+01	0.130E+08	0.200E+04	0.620E+03	0.200E+04	0.620E+03
		1.5	55.0		0.202E+08		0.399E+03		0.399E+03
		1.0	55.0		0.289E+08		0.278E+03		0.278E+03
		0.5	55.0		0.389E+08		0.207E+03		0.207E+03
Ethylbenzene	119	2.0	55.0	0.100E+01	0.540E+07	0.400E+04	0.335E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.839E+07		0.216E+04		-0.999E+01
		1.0	55.0		0.120E+08		0.151E+04		-0.999E+01
		0.5	55.0		0.162E+08		0.112E+04		-0.999E+01
Styrene	276	2.0	55.0	0.100E+01	0.395E+07	0.400E+03	0.450E+03	0.400E+03	0.450E+03
		1.5	55.0		0.614E+07		0.290E+03		0.290E+03
		1.0	55.0		0.881E+07		0.202E+03		0.202E+03
		0.5	55.0		0.119E+08		0.150E+03		0.150E+03
Napthalene	213	2.0	55.0	0.100E+01	0.709E+05	0.360E+02	0.277E+04	0.225E+02	0.174E+04
		1.5	55.0		0.110E+06		0.179E+04		0.112E+04
		1.0	55.0		0.158E+06		0.125E+04		0.779E+03
		0.5	55.0		0.213E+06		0.924E+03		0.578E+03
Chloromethane	191	2.0	55.0	0.100E+01	0.380E+09	0.200E+05	0.114E+03	0.700E+04	0.397E+02
		1.5	55.0		0.589E+09		0.732E+02		0.256E+02
		1.0	55.0		0.843E+09		0.512E+02		0.179E+02
		0.5	55.0		0.113E+10		0.382E+02		0.134E+02
Bromomethane	190	2.0	55.0	0.100E+01	0.217E+09	0.400E+04	0.747E+02	0.135E+04	0.252E+02
		1.5	55.0		0.337E+09		0.481E+02		0.162E+02
		1.0	55.0		0.483E+09		0.336E+02		0.113E+02
		0.5	55.0		0.649E+09		0.250E+02		0.843E+01
Carbon tetrachloride	54	2.0	55.0	0.100E+01	0.190E+08	0.180E+04	0.622E+03	0.600E+03	0.207E+03
		1.5	55.0		0.295E+08		0.400E+03		0.133E+03
		1.0	55.0		0.423E+08		0.279E+03		0.931E+02
		0.5	55.0		0.570E+08		0.208E+03		0.692E+02
1,2-Dichlorethane	125	2.0	55.0	0.100E+01	0.907E+07	0.120E+04	0.559E+03	0.400E+03	0.186E+03
		1.5	55.0		0.141E+08		0.360E+03		0.120E+03
		1.0	55.0		0.202E+08		0.251E+03		0.838E+02
		0.5	55.0		0.271E+08		0.187E+03		0.623E+02
1,1-Dichloroethylene	306	2.0	55.0	0.100E+01	0.308E+09	0.700E+02	0.937E+00	0.350E+02	0.469E+00
		1.5	55.0		0.478E+09		0.604E+00		0.302E+00
		1.0	55.0		0.685E+09		0.421E+00		0.211E+00
		0.5	55.0		0.921E+09		0.313E+00		0.157E+00
Trichloroethylene	296	2.0	55.0	0.100E+01	0.364E+08	0.850E+05	0.958E+04	0.280E+05	0.318E+04
		1.5	55.0		0.565E+08		0.619E+04		0.205E+04
		1.0	55.0		0.810E+08		0.433E+04		0.143E+04
		0.5	55.0		0.109E+09		0.322E+04		0.106E+04
1,2-Dichloropropane	256	2.0	55.0	0.100E+01	0.253E+08	0.240E+04	0.392E+03	0.240E+04	0.392E+03
		1.5	55.0		0.393E+08		0.253E+03		0.253E+03
		1.0	55.0		0.564E+08		0.176E+03		0.176E+03
		0.5	55.0		0.759E+08		0.131E+03		0.131E+03
Tetracloroethylene	235	2.0	55.0	0.100E+01	0.106E+08	0.100E+05	0.453E+04	0.400E+04	0.182E+04
		1.5	55.0		0.165E+08		0.292E+04		0.117E+04
		1.0	55.0		0.236E+08		0.204E+04		0.816E+03
		0.5	55.0		0.318E+08		0.151E+04		0.606E+03
Chlorobenzene	211	2.0	55.0	0.100E+01	0.838E+07	0.420E+04	0.293E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.130E+08		0.189E+04		-0.999E+01
		1.0	55.0		0.187E+08		0.132E+04		-0.999E+01
		0.5	55.0		0.252E+08		0.979E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	55.0	0.100E+01	0.786E+06	0.370E+05	0.182E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.122E+07		0.126E+06		-0.999E+01
		1.0	55.0		0.175E+07		0.915E+06		-0.999E+01
		0.5	55.0		0.236E+07		0.697E+05		-0.999E+01

Table B3.9 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	55.0	0.100E+01	0.361E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.526E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.709E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.884E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	55.0	0.100E+01	0.161E+08	0.200E+04	0.499E+03	0.200E+04	0.499E+03
		1.5	55.0		0.235E+08		0.342E+03		0.342E+03
		1.0	55.0		0.317E+08		0.254E+03		0.254E+03
		0.5	55.0		0.395E+08		0.203E+03		0.203E+03
Ethylbenzene	119	2.0	55.0	0.100E+01	0.671E+07	0.400E+04	0.270E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.979E+07		0.185E+04		-0.999E+01
		1.0	55.0		0.132E+08		0.137E+04		-0.999E+01
		0.5	55.0		0.165E+08		0.110E+04		-0.999E+01
Styrene	276	2.0	55.0	0.100E+01	0.491E+07	0.400E+03	0.363E+03	0.400E+03	0.363E+03
		1.5	55.0		0.716E+07		0.249E+03		0.249E+03
		1.0	55.0		0.965E+07		0.184E+03		0.184E+03
		0.5	55.0		0.121E+08		0.148E+03		0.148E+03
Napthalene	213	2.0	55.0	0.100E+01	0.881E+05	0.360E+02	0.223E+04	0.225E+02	0.140E+04
		1.5	55.0		0.129E+06		0.153E+04		0.958E+03
		1.0	55.0		0.173E+06		0.114E+04		0.711E+03
		0.5	55.0		0.217E+06		0.909E+03		0.568E+03
Chloromethane	191	2.0	55.0	0.100E+01	0.471E+09	0.200E+05	0.917E+02	0.700E+04	0.321E+02
		1.5	55.0		0.685E+09		0.630E+02		0.220E+02
		1.0	55.0		0.921E+09		0.468E+02		0.164E+02
		0.5	55.0		0.114E+10		0.377E+02		0.132E+02
Bromomethane	190	2.0	55.0	0.100E+01	0.269E+09	0.400E+04	0.602E+02	0.135E+04	0.203E+02
		1.5	55.0		0.393E+09		0.413E+02		0.139E+02
		1.0	55.0		0.529E+09		0.307E+02		0.104E+02
		0.5	55.0		0.658E+09		0.246E+02		0.832E+01
Carbon tetrachloride	54	2.0	55.0	0.100E+01	0.236E+08	0.180E+04	0.501E+03	0.600E+03	0.167E+03
		1.5	55.0		0.344E+08		0.343E+03		0.115E+03
		1.0	55.0		0.464E+08		0.255E+03		0.851E+02
		0.5	55.0		0.579E+08		0.204E+03		0.682E+02
1,2-Dichlorethane	125	2.0	55.0	0.100E+01	0.113E+08	0.120E+04	0.451E+03	0.400E+03	0.150E+03
		1.5	55.0		0.164E+08		0.309E+03		0.103E+03
		1.0	55.0		0.221E+08		0.230E+03		0.766E+02
		0.5	55.0		0.275E+08		0.184E+03		0.614E+02
1,1-Dichloroethylene	306	2.0	55.0	0.100E+01	0.382E+09	0.700E+02	0.756E+00	0.350E+02	0.378E+00
		1.5	55.0		0.557E+09		0.518E+00		0.259E+00
		1.0	55.0		0.749E+09		0.385E+00		0.193E+00
		0.5	55.0		0.934E+09		0.309E+00		0.155E+00
Trichloroethylene	296	2.0	55.0	0.100E+01	0.451E+08	0.850E+05	0.774E+04	0.280E+05	0.256E+04
		1.5	55.0		0.658E+08		0.532E+04		0.176E+04
		1.0	55.0		0.886E+08		0.396E+04		0.131E+04
		0.5	55.0		0.111E+09		0.317E+04		0.105E+04
1,2-Dichloropropane	256	2.0	55.0	0.100E+01	0.314E+08	0.240E+04	0.316E+03	0.240E+04	0.316E+03
		1.5	55.0		0.458E+08		0.217E+03		0.217E+03
		1.0	55.0		0.617E+08		0.161E+03		0.161E+03
		0.5	55.0		0.770E+08		0.129E+03		0.129E+03
Tetracloroethylene	235	2.0	55.0	0.100E+01	0.132E+08	0.100E+05	0.356E+04	0.400E+04	0.146E+04
		1.5	55.0		0.192E+08		0.251E+04		0.100E+04
		1.0	55.0		0.259E+08		0.186E+04		0.745E+03
		0.5	55.0		0.323E+08		0.149E+04		0.597E+03
Chlorobenzene	211	2.0	55.0	0.100E+01	0.104E+07	0.420E+04	0.236E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.152E+08		0.162E+04		-0.999E+01
		1.0	55.0		0.205E+08		0.120E+04		-0.999E+01
		0.5	55.0		0.256E+08		0.964E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	55.0	0.100E+01	0.976E+06	0.370E+05	0.152E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.142E+07		0.110E+06		-0.999E+01
		1.0	55.0		0.192E+07		0.842E+05		-0.999E+01
		0.5	55.0		0.240E+07		0.686E+05		-0.999E+01

Table B3.10 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.050
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	55.0	0.100E+01	0.226E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.322E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.449E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.631E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	55.0	0.100E+01	0.101E+08	0.200E+04	0.798E+03	0.200E+04	0.798E+03
		1.5	55.0		0.144E+08		0.560E+03		0.560E+03
		1.0	55.0		0.200E+08		0.401E+03		0.401E+03
		0.5	55.0		0.282E+08		0.285E+03		0.285E+03
Ethylbenzene	119	2.0	55.0	0.100E+01	0.419E+07	0.400E+04	0.431E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.598E+07		0.303E+04		-0.999E+01
		1.0	55.0		0.834E+07		0.217E+04		-0.999E+01
		0.5	55.0		0.117E+08		0.154E+04		-0.999E+01
Styrene	276	2.0	55.0	0.100E+01	0.307E+07	0.400E+03	0.580E+03	0.400E+03	0.580E+03
		1.5	55.0		0.438E+07		0.407E+03		0.407E+03
		1.0	55.0		0.610E+07		0.292E+03		0.292E+03
		0.5	55.0		0.860E+07		0.207E+03		0.207E+03
Napthalene	213	2.0	55.0	0.100E+01	0.550E+05	0.360E+02	0.357E+04	0.225E+02	0.223E+04
		1.5	55.0		0.785E+05		0.250E+04		0.157E+04
		1.0	55.0		0.110E+06		0.180E+04		0.112E+04
		0.5	55.0		0.154E+06		0.128E+04		0.798E+03
Chloromethane	191	2.0	55.0	0.100E+01	0.295E+09	0.200E+05	0.146E+03	0.700E+04	0.512E+02
		1.5	55.0		0.420E+09		0.103E+03		0.359E+02
		1.0	55.0		0.585E+09		0.737E+02		0.258E+02
		0.5	55.0		0.821E+09		0.526E+02		0.184E+02
Bromomethane	190	2.0	55.0	0.100E+01	0.169E+09	0.400E+04	0.961E+02	0.135E+04	0.325E+02
		1.5	55.0		0.241E+09		0.675E+02		0.228E+02
		1.0	55.0		0.335E+09		0.484E+02		0.163E+02
		0.5	55.0		0.471E+09		0.345E+02		0.116E+02
Carbon tetrachloride	54	2.0	55.0	0.100E+01	0.148E+08	0.180E+04	0.800E+03	0.600E+03	0.267E+03
		1.5	55.0		0.211E+08		0.561E+03		0.187E+03
		1.0	55.0		0.294E+08		0.403E+03		0.134E+03
		0.5	55.0		0.413E+08		0.286E+03		0.955E+02
1,2-Dichlorethane	125	2.0	55.0	0.100E+01	0.705E+07	0.120E+04	0.720E+03	0.400E+03	0.240E+03
		1.5	55.0		0.100E+08		0.505E+03		0.168E+03
		1.0	55.0		0.140E+08		0.362E+03		0.121E+03
		0.5	55.0		0.197E+08		0.258E+03		0.859E+02
1,1-Dichloroethylene	306	2.0	55.0	0.100E+01	0.239E+09	0.700E+02	0.121E+01	0.350E+02	0.604E+00
		1.5	55.0		0.341E+09		0.847E+00		0.423E+00
		1.0	55.0		0.475E+09		0.608E+00		0.304E+00
		0.5	55.0		0.668E+09		0.432E+00		0.216E+00
Trichloroethylene	296	2.0	55.0	0.100E+01	0.283E+08	0.850E+05	0.123E+05	0.280E+05	0.409E+04
		1.5	55.0		0.403E+08		0.866E+04		0.287E+04
		1.0	55.0		0.561E+08		0.623E+04		0.206E+04
		0.5	55.0		0.790E+09		0.444E+04		0.147E+04
1,2-Dichloropropane	256	2.0	55.0	0.100E+01	0.197E+08	0.240E+04	0.505E+03	0.240E+04	0.505E+03
		1.5	55.0		0.280E+08		0.354E+03		0.354E+03
		1.0	55.0		0.391E+08		0.254E+03		0.254E+03
		0.5	55.0		0.550E+08		0.181E+03		0.181E+03
Tetracloroethylene	235	2.0	55.0	0.100E+01	0.824E+07	0.100E+05	0.582E+04	0.400E+04	0.234E+04
		1.5	55.0		0.118E+08		0.409E+04		0.164E+04
		1.0	55.0		0.164E+08		0.294E+04		0.118E+04
		0.5	55.0		0.231E+08		0.209E+04		0.837E+03
Chlorobenzene	211	2.0	55.0	0.100E+01	0.651E+07	0.420E+04	0.377E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.928E+07		0.265E+04		-0.999E+01
		1.0	55.0		0.129E+08		0.190E+04		-0.999E+01
		0.5	55.0		0.182E+08		0.135E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	55.0	0.100E+01	0.610E+06	0.370E+05	0.221E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.870E+06		0.167E+06		-0.999E+01
		1.0	55.0		0.121E+07		0.126E+06		-0.999E+01
		0.5	55.0		0.171E+07		0.935E+05		-0.999E+01

Table B3.11 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	55.0	0.100E+01	0.267E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.363E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.481E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.632E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	55.0	0.100E+01	0.119E+08	0.200E+04	0.675E+03	0.200E+04	0.675E+03
		1.5	55.0		0.162E+08		0.496E+03		0.496E+03
		1.0	55.0		0.212E+08		0.364E+03		0.374E+03
		0.5	55.0		0.282E+08		0.285E+03		0.285E+03
Ethylbenzene	119	2.0	55.0	0.100E+01	0.496E+07	0.400E+04	0.365E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.674E+07		0.268E+04		-0.999E+01
		1.0	55.0		0.894E+07		0.202E+04		-0.999E+01
		0.5	55.0		0.118E+08		0.154E+04		-0.999E+01
Styrene	276	2.0	55.0	0.100E+01	0.363E+07	0.400E+03	0.491E+03	0.400E+03	0.491E+03
		1.5	55.0		0.494E+07		0.361E+03		0.361E+03
		1.0	55.0		0.655E+07		0.272E+03		0.272E+03
		0.5	55.0		0.860E+07		0.207E+03		0.207E+03
Napthalene	213	2.0	55.0	0.100E+01	0.651E+05	0.360E+02	0.302E+04	0.225E+02	0.189E+04
		1.5	55.0		0.886E+05		0.222E+04		0.139E+04
		1.0	55.0		0.117E+06		0.168E+04		0.105E+04
		0.5	55.0		0.154E+06		0.127E+04		0.797E+03
Chloromethane	191	2.0	55.0	0.100E+01	0.348E+09	0.200E+05	0.124E+03	0.700E+04	0.434E+02
		1.5	55.0		0.473E+09		0.912E+02		0.319E+02
		1.0	55.0		0.626E+09		0.689E+02		0.241E+02
		0.5	55.0		0.820E+09		0.526E+02		0.184E+02
Bromomethane	190	2.0	55.0	0.100E+01	0.199E+09	0.400E+04	0.815E+02	0.135E+04	0.275E+02
		1.5	55.0		0.271E+09		0.599E+02		0.202E+02
		1.0	55.0		0.359E+09		0.452E+02		0.153E+02
		0.5	55.0		0.471E+09		0.345E+02		0.116E+02
Carbon tetrachloride	54	2.0	55.0	0.100E+01	0.174E+08	0.180E+04	0.678E+03	0.600E+03	0.226E+03
		1.5	55.0		0.237E+08		0.498E+03		0.166E+03
		1.0	55.0		0.315E+08		0.376E+03		0.125E+03
		0.5	55.0		0.413E+08		0.286E+03		0.954E+02
1,2-Dichlorethane	125	2.0	55.0	0.100E+01	0.832E+07	0.120E+04	0.610E+03	0.400E+03	0.203E+03
		1.5	55.0		0.113E+08		0.448E+03		0.149E+03
		1.0	55.0		0.150E+08		0.338E+03		0.113E+03
		0.5	55.0		0.197E+08		0.258E+03		0.860E+02
1,1-Dichloroethylene	306	2.0	55.0	0.100E+01	0.282E+09	0.700E+02	0.102E+01	0.350E+02	0.511E+00
		1.5	55.0		0.384E+09		0.752E+00		0.376E+00
		1.0	55.0		0.509E+09		0.567E+00		0.284E+00
		0.5	55.0		0.668E+09		0.432E+00		0.216E+00
Trichloroethylene	296	2.0	55.0	0.100E+01	0.334E+08	0.850E+05	0.104E+05	0.280E+05	0.346E+04
		1.5	55.0		0.454E+08		0.769E+04		0.255E+04
		1.0	55.0		0.602E+08		0.582E+04		0.192E+04
		0.5	55.0		0.790E+08		0.444E+04		0.147E+04
1,2-Dichloropropane	256	2.0	55.0	0.100E+01	0.232E+08	0.240E+04	0.428E+03	0.240E+04	0.428E+03
		1.5	55.0		0.316E+08		0.314E+03		0.314E+03
		1.0	55.0		0.419E+08		0.237E+03		0.237E+03
		0.5	55.0		0.550E+08		0.181E+03		0.181E+03
Tetracloroethylene	235	2.0	55.0	0.100E+01	0.974E+07	0.100E+05	0.493E+04	0.400E+04	0.198E+04
		1.5	55.0		0.133E+08		0.363E+04		0.146E+04
		1.0	55.0		0.176E+08		0.274E+04		0.110E+04
		0.5	55.0		0.231E+08		0.209E+04		0.836E+03
Chlorobenzene	211	2.0	55.0	0.100E+01	0.769E+07	0.420E+04	0.319E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.105E+08		0.235E+04		-0.999E+01
		1.0	55.0		[illegible].139E+08		0.177E+04		-0.999E+01
		0.5	55.0		0.182E+08		0.135E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	55.0	0.100E+01	0.721E+06	0.370E+05	0.194E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.982E+06		0.151E+06		-0.999E+01
		1.0	55.0		0.130E+07		0.119E+06		-0.999E+01
		0.5	55.0		0.171E+07		0.934E+05		-0.999E+01

Table B3.12 Summary table without soil resistance.

SOURCE DIMENSION (M) = 50 X 50
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	55.0	0.100E+01	0.310E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	55.0		0.402E+08		-0.999E+01		-0.999E+01
		1.0	55.0		0.506E+08		-0.999E+01		-0.999E+01
		0.5	55.0		0.620E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	55.0	0.100E+01	0.138E+08	0.200E+04	0.581E+03	0.200E+04	0.581E+03
		1.5	55.0		0.180E+08		0.448E+03		0.448E+03
		1.0	55.0		0.226E+08		0.356E+03		0.356E+03
		0.5	55.0		0.277E+08		0.290E+03		0.290E+03
Ethylbenzene	119	2.0	55.0	0.100E+01	0.577E+07	0.400E+04	0.314E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.748E+07		0.242E+04		-0.999E+01
		1.0	55.0		0.942E+07		0.192E+04		-0.999E+01
		0.5	55.0		0.116E+08		0.157E+04		-0.999E+01
Styrene	276	2.0	55.0	0.100E+01	0.422E+07	0.400E+03	0.422E+03	0.400E+03	0.422E+03
		1.5	55.0		0.547E+07		0.325E+03		0.325E+03
		1.0	55.0		0.689E+07		0.258E+03		0.258E+03
		0.5	55.0		0.854E+07		0.211E+03		0.211E+03
Napthalene	213	2.0	55.0	0.100E+01	0.757E+05	0.360E+02	0.260E+04	0.225E+02	0.162E+04
		1.5	55.0		0.982E+05		0.200E+04		0.125E+04
		1.0	55.0		0.124E+06		0.159E+04		0.995E+03
		0.5	55.0		0.152E+06		0.130E+04		0.811E+03
Chloromethane	191	2.0	55.0	0.100E+01	0.404E+09	0.200E+05	0.107E+03	0.700E+04	0.374E+02
		1.5	55.0		0.523E+09		0.825E+02		0.289E+02
		1.0	55.0		0.658E+09		0.656E+02		0.230E+02
		0.5	55.0		0.803E+09		0.537E+02		0.188E+02
Bromomethane	190	2.0	55.0	0.100E+01	0.232E+09	0.400E+04	0.701E+02	0.135E+04	0.237E+02
		1.5	55.0		0.300E+09		0.541E+02		0.183E+02
		1.0	55.0		0.378E+09		0.430E+02		0.145E+02
		0.5	55.0		0.462E+09		0.351E+02		0.119E+02
Carbon tetrachloride	54	2.0	55.0	0.100E+01	0.203E+08	0.180E+04	0.583E+03	0.600E+03	0.194E+03
		1.5	55.0		0.263E+08		0.449E+03		0.150E+03
		1.0	55.0		0.331E+08		0.357E+03		0.119E+03
		0.5	55.0		0.406E+08		0.291E+03		0.972E+02
1,2-Dichlorethane	125	2.0	55.0	0.100E+01	0.967E+07	0.120E+04	0.524E+03	0.400E+03	0.175E+03
		1.5	55.0		0.125E+08		0.405E+03		0.135E+03
		1.0	55.0		0.158E+08		0.322E+03		0.107E+03
		0.5	55.0		0.193E+08		0.263E+03		0.876E+02
1,1-Dichloroethylene	306	2.0	55.0	0.100E+01	0.328E+09	0.700E+02	0.880E+00	0.350E+02	0.440E+00
		1.5	55.0		0.425E+09		0.679E+00		0.339E+00
		1.0	55.0		0.535E+09		0.539E+00		0.270E+00
		0.5	55.0		0.655E+09		0.440E+00		0.220E+00
Trichloroethylene	296	2.0	55.0	0.100E+01	0.388E+08	0.850E+05	0.899E+04	0.280E+05	0.298E+04
		1.5	55.0		0.503E+08		0.695E+04		0.230E+04
		1.0	55.0		0.633E+08		0.553E+04		0.183E+04
		0.5	55.0		0.775E+08		0.452E+04		0.149E+04
1,2-Dichloropropane	256	2.0	55.0	0.100E+01	0.270E+08	0.240E+04	0.368E+03	0.240E+04	0.368E+03
		1.5	55.0		0.350E+08		0.284E+03		0.284E+03
		1.0	55.0		0.441E+08		0.225E+03		0.225E+03
		0.5	55.0		0.540E+08		0.184E+03		0.184E+03
Tetracloroethylene	235	2.0	55.0	0.100E+01	0.113E+08	0.100E+05	0.424E+04	0.400E+04	0.170E+04
		1.5	55.0		0.147E+08		0.328E+04		0.131E+04
		1.0	55.0		0.185E+08		0.260E+04		0.104E+04
		0.5	55.0		0.227E+08		0.213E+04		0.851E+03
Chlorobenzene	211	2.0	55.0	0.100E+01	0.895E+07	0.420E+04	0.275E+04	-0.100E+04	-0.999E+01
		1.5	55.0		0.116E+08		0.212E+04		-0.999E+01
		1.0	55.0		0.146E+08		0.168E+04		-0.999E+01
		0.5	55.0		0.179E+08		0.137E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	55.0	0.100E+01	0.839E+06	0.370E+05	0.172E+06	-0.100E+04	-0.999E+01
		1.5	55.0		0.109E+07		0.139E+06		-0.999E+01
		1.0	55.0		0.137E+07		0.114E+06		-0.999E+01
		0.5	55.0		0.168E+07		0.949E+05		-0.999E+01

Table B3.13 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.050
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.402E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.580E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.795E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.105E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.179E+08	0.200E+04	0.449E+03	0.200E+04	0.449E+03
		1.5	105.0		0.259E+08		0.311E+03		0.311E+03
		1.0	105.0		0.355E+08		0.227E+03		0.227E+03
		0.5	105.0		0.471E+08		0.171E+03		0.171E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.746E+07	0.400E+04	0.243E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.108E+08		0.168E+04		-0.999E+01
		1.0	105.0		0.148E+08		0.123E+04		-0.999E+01
		0.5	105.0		0.196E+08		0.924E+03		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.546E+07	0.400E+03	0.326E+03	0.400E+03	0.326E+03
		1.5	105.0		0.789E+07		0.226E+03		0.226E+03
		1.0	105.0		0.108E+08		0.164E+03		0.164E+03
		0.5	105.0		0.144E+08		0.124E+03		0.124E+03
Napthalene	213	2.0	105.0	0.100E+01	0.980E+05	0.360E+02	0.201E+04	0.225E+02	0.126E+04
		1.5	105.0		0.142E+06		0.139E+04		0.870E+03
		1.0	105.0		0.194E+06		0.101E+04		0.634E+03
		0.5	105.0		0.258E+06		0.764E+03		0.477E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.524E+09	0.200E+05	0.823E+02	0.700E+04	0.288E+02
		1.5	105.0		0.756E+09		0.571E+02		0.200E+02
		1.0	105.0		0.103E+10		0.417E+02		0.146E+02
		0.5	105.0		0.137E+10		0.316E+02		0.111E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.300E+09	0.400E+04	0.541E+02	0.135E+04	0.183E+02
		1.5	105.0		0.433E+09		0.375E+02		0.126E+02
		1.0	105.0		0.593E+09		0.274E+02		0.923E+01
		0.5	105.0		0.785E+09		0.207E+02		0.697E+01
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.263E+08	0.180E+04	0.450E+03	0.600E+03	0.150E+03
		1.5	105.0		0.379E+08		0.312E+03		0.104E+03
		1.0	105.0		0.520E+08		0.227E+03		0.758E+02
		0.5	105.0		0.689E+08		0.172E+03		0.572E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.125E+08	0.120E+04	0.405E+03	0.400E+03	0.135E+03
		1.5	105.0		0.181E+08		0.280E+03		0.935E+03
		1.0	105.0		0.248E+08		0.205E+03		0.682E+02
		0.5	105.0		0.328E+08		0.155E+03		0.515E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.425E+09	0.700E+02	0.679E+00	0.350E+02	0.339E+00
		1.5	105.0		0.614E+09		0.470E+00		0.235E+00
		1.0	105.0		0.841E+09		0.343E+00		0.172E+00
		0.5	105.0		0.111E+10		0.259E+00		0.130E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.502E+08	0.850E+05	0.696E+04	0.280E+05	0.230E+04
		1.5	105.0		0.726E+08		0.483E+04		0.160E+04
		1.0	105.0		0.994E+08		0.353E+04		0.116E+04
		0.5	105.0		0.132E+09		0.266E+04		0.879E+03
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.350E+08	0.240E+04	0.284E+03	0.240E+04	0.284E+03
		1.5	105.0		0.505E+08		0.197E+03		0.197E+03
		1.0	105.0		0.692E+08		0.144E+03		0.144E+03
		0.5	105.0		0.918E+08		0.108E+03		0.108E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.147E+08	0.100E+05	0.328E+04	0.400E+04	0.132E+04
		1.5	105.0		0.212E+08		0.227E+04		0.911E+03
		1.0	105.0		0.290E+08		0.166E+04		0.665E+03
		0.5	105.0		0.385E+08		0.125E+04		0.501E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.116E+08	0.420E+04	0.212E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.167E+08		0.147E+04		-0.999E+01
		1.0	105.0		0.229E+08		0.107E+04		-0.999E+01
		0.5	105.0		0.304E+08		0.809E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.109E+07	0.370E+05	0.139E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.157E+07		0.101E+06		-0.999E+01
		1.0	105.0		0.215E+07		0.758E+05		-0.999E+01
		0.5	105.0		0.286E+07		0.583E+05		-0.999E+01

Table B3.14 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.467E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.648E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.851E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.106E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.209E+08	0.200E+04	0.385E+03	0.200E+04	0.385E+03
		1.5	105.0		0.289E+08		0.278E+03		0.278E+03
		1.0	105.0		0.380E+08		0.212E+03		0.212E+03
		0.5	105.0		0.476E+08		0.169E+03		0.169E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.869E+07	0.400E+04	0.208E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.121E+08		0.150E+04		-0.999E+01
		1.0	105.0		0.158E+08		0.114E+04		-0.999E+01
		0.5	105.0		0.198E+08		0.915E+03		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.636E+07	0.400E+03	0.280E+03	0.400E+03	0.280E+03
		1.5	105.0		0.882E+07		0.202E+03		0.202E+03
		1.0	105.0		0.116E+08		0.154E+03		0.154E+03
		0.5	105.0		0.145E+08		0.123E+03		0.123E+03
Napthalene	213	2.0	105.0	0.100E+01	0.114E+06	0.360E+02	0.172E+04	0.225E+02	0.108E+04
		1.5	105.0		0.158E+06		0.124E+04		0.777E+03
		1.0	105.0		0.208E+06		0.946E+03		0.592E+03
		0.5	105.0		0.261E+06		0.756E+03		0.472E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.609E+09	0.200E+05	0.709E+02	0.700E+04	0.248E+02
		1.5	105.0		0.843E+09		0.512E+02		0.179E+02
		1.0	105.0		0.111E+10		0.390E+02		0.137E+02
		0.5	105.0		0.138E+10		0.314E+02		0.110E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.349E+09	0.400E+04	0.465E+02	0.135E+04	0.157E+02
		1.5	105.0		0.484E+09		0.336E+02		0.113E+02
		1.0	105.0		0.635E+09		0.256E+02		0.863E+01
		0.5	105.0		0.792E+09		0.205E+02		0.692E+01
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.306E+08	0.180E+04	0.387E+03	0.600E+03	0.129E+03
		1.5	105.0		0.424E+08		0.279E+03		0.930E+02
		1.0	105.0		0.557E+08		0.212E+03		0.708E+02
		0.5	105.0		0.696E+08		0.170E+03		0.567E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.146E+08	0.120E+04	0.348E+03	0.400E+03	0.116E+03
		1.5	105.0		0.202E+08		0.251E+03		0.837E+02
		1.0	105.0		0.265E+08		0.191E+03		0.638E+02
		0.5	105.0		0.331E+08		0.153E+03		0.511E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.495E+09	0.700E+02	0.584E+00	0.350E+02	0.292E+00
		1.5	105.0		0.686E+09		0.421E+00		0.211E+00
		1.0	105.0		0.900E+09		0.321E+00		0.160E+00
		0.5	105.0		0.112E+10		0.257E+00		0.128E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.585E+08	0.850E+05	0.599E+04	0.280E+05	0.198E+04
		1.5	105.0		0.811E+08		0.432E+04		0.143E+04
		1.0	105.0		0.106E+09		0.530E+04		0.109E+04
		0.5	105.0		0.133E+09		0.264E+04		0.372E+03
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.407E+08	0.240E+04	0.244E+03	0.240E+04	0.244E+03
		1.5	105.0		0.564E+08		0.176E+03		0.176E+03
		1.0	105.0		0.741E+08		0.134E+03		0.134E+03
		0.5	105.0		0.926E+08		0.107E+03		0.107E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.171E+08	0.100E+05	0.282E+04	0.400E+04	0.113E+04
		1.5	105.0		0.237E+08		0.204E+04		0.815E+03
		1.0	105.0		0.311E+08		0.155E+04		0.621E+03
		0.5	105.0		0.389E+08		0.124E+04		0.497E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.135E+08	0.420E+04	0.182E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.187E+08		0.132E+04		-0.999E+01
		1.0	105.0		0.246E+08		0.100E+04		-0.999E+01
		0.5	105.0		0.307E+08		0.801E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.126E+07	0.370E+05	0.122E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.175E+07		0.913E+05		-0.999E+01
		1.0	105.0		0.231E+07		0.712E+05		-0.999E+01
		0.5	105.0		0.289E+07		0.578E+05		-0.999E+01

Table B3.15 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.100

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.540E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.718E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.901E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.106E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.241E+08	0.200E+04	0.333E+03	0.200E+04	0.333E+03
		1.5	105.0		0.321E+08		0.251E+03		0.251E+03
		1.0	105.0		0.403E+08		0.200E+03		0.200E+03
		0.5	105.0		0.475E+08		0.169E+03		0.169E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.100E+08	0.400E+04	0.180E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.134E+08		0.136E+04		-0.999E+01
		1.0	105.0		0.168E+08		0.108E+04		-0.999E+01
		0.5	105.0		0.198E+08		0.916E+03		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.735E+07	0.400E+03	0.242E+03	0.400E+03	0.242E+03
		1.5	105.0		0.978E+07		0.182E+03		0.182E+03
		1.0	105.0		0.123E+08		0.145E+03		0.145E+03
		0.5	105.0		0.145E+08		0.123E+03		0.123E+03
Napthalene	213	2.0	105.0	0.100E+01	0.132E+06	0.360E+02	0.149E+04	0.225E+02	0.932E+03
		1.5	105.0		0.176E+06		0.112E+04		0.701E+03
		1.0	105.0		0.221E+06		0.893E+03		0.558E+03
		0.5	105.0		0.261E+06		0.756E+03		0.473E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.702E+09	0.200E+05	0.615E+02	0.700E+04	0.215E+02
		1.5	105.0		0.932E+09		0.463E+02		0.162E+02
		1.0	105.0		0.117E+10		0.369E+02		0.129E+02
		0.5	105.0		0.137E+10		0.315E+02		0.110E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.403E+09	0.400E+04	0.403E+02	0.135E+04	0.136E+02
		1.5	105.0		0.535E+09		0.303E+02		0.102E+02
		1.0	105.0		0.671E+09		0.242E+02		0.816E+01
		0.5	105.0		0.790E+09		0.205E+02		0.694E+01
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.353E+08	0.180E+04	0.335E+03	0.600E+03	0.112E+03
		1.5	105.0		0.470E+08		0.252E+03		0.840E+02
		1.0	105.0		0.590E+08		0.201E+03		0.669E+02
		0.5	105.0		0.695E+08		0.170E+03		0.568E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.168E+08	0.120E+04	0.301E+03	0.400E+03	0.100E+03
		1.5	105.0		0.224E+08		0.227E+03		0.756E+02
		1.0	105.0		0.281E+08		0.181E+03		0.603E+02
		0.5	105.0		0.330E+08		0.154E+03		0.512E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.571E+09	0.700E+02	0.505E+00	0.350E+02	0.253E+00
		1.5	105.0		0.759E+09		0.380E+00		0.190E+00
		1.0	105.0		0.952E+09		0.303E+00		0.152E+00
		0.5	105.0		0.112E+10		0.258E+00		0.129E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.675E+08	0.850E+05	0.519E+04	0.280E+05	0.171E+04
		1.5	105.0		0.898E+08		0.391E+04		0.129E+04
		1.0	105.0		0.113E+09		0.311E+04		0.103E+04
		0.5	105.0		0.133E+09		0.265E+04		0.873E+03
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.470E+08	0.240E+04	0.211E+03	0.240E+04	0.211E+03
		1.5	105.0		0.625E+08		0.159E+03		0.159E+03
		1.0	105.0		0.785E+08		0.127E+03		0.127E+03
		0.5	105.0		0.925E+08		0.108E+03		0.108E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.197E+08	0.100E+05	0.244E+04	0.400E+04	0.978E+03
		1.5	105.0		0.262E+08		0.184E+04		0.736E+03
		1.0	105.0		0.329E+08		0.146E+04		0.586E+03
		0.5	105.0		0.388E+08		0.124E+04		0.497E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.156E+08	0.420E+04	0.158E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.207E+08		0.119E+04		-0.999E+01
		1.0	105.0		0.260E+08		0.946E+04		-0.999E+01
		0.5	105.0		0.307E+08		0.802E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.146E+07	0.370E+05	0.107E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.195E+07		0.832E+05		-0.999E+01
		1.0	105.0		0.244E+07		0.675E+05		-0.999E+01
		0.5	105.0		0.288E+07		0.578E+05		-0.999E+01

Table B3.16 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.050
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.328E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.433E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.564E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.742E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.147E+08	0.200E+04	0.548E+03	0.200E+04	0.548E+03
		1.5	105.0		0.193E+08		0.416E+03		0.416E+03
		1.0	105.0		0.252E+08		0.320E+03		0.320E+03
		0.5	105.0		0.331E+08		0.243E+03		0.243E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.610E+08	0.400E+04	0.296E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.805E+08		0.225E+04		-0.999E+01
		1.0	105.0		0.105E+08		0.173E+04		-0.999E+01
		0.5	105.0		0.138E+08		0.131E+04		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.447E+07	0.400E+03	0.398E+03	0.400E+03	0.398E+03
		1.5	105.0		0.589E+07		0.302E+03		0.302E+03
		1.0	105.0		0.767E+07		0.232E+03		0.232E+03
		0.5	105.0		0.101E+08		0.176E+03		0.176E+03
Napthalene	213	2.0	105.0	0.100E+01	0.802E+05	0.360E+02	0.245E+04	0.225E+02	0.153E+04
		1.5	105.0		0.106E+06		0.186E+04		0.116E+04
		1.0	105.0		0.138E+06		0.143E+04		0.894E+03
		0.5	105.0		0.181E+06		0.109E+04		0.679E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.428E+09	0.200E+05	0.101E+03	0.700E+04	0.353E+02
		1.5	105.0		0.564E+09		0.765E+02		0.268E+02
		1.0	105.0		0.733E+09		0.588E+02		0.206E+02
		0.5	105.0		0.963E+09		0.448E+02		0.157E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.245E+09	0.400E+04	0.662E+02	0.135E+04	0.223E+02
		1.5	105.0		0.323E+09		0.502E+02		0.170E+02
		1.0	105.0		0.421E+09		0.386E+02		0.130E+02
		0.5	105.0		0.535E+09		0.293E+02		0.990E+01
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.215E+08	0.180E+04	0.550E+03	0.600E+03	0.184E+03
		1.5	105.0		0.283E+08		0.418E+03		0.139E+03
		1.0	105.0		0.369E+08		0.321E+03		0.107E+03
		0.5	105.0		0.485E+08		0.244E+03		0.813E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.102E+08	0.120E+04	0.495E+03	0.400E+03	0.165E+03
		1.5	105.0		0.135E+08		0.376E+03		0.125E+03
		1.0	105.0		0.176E+08		0.289E+03		0.963E+02
		0.5	105.0		0.231E+08		0.220E+03		0.732E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.348E+09	0.700E+02	0.830E+00	0.350E+02	0.415E+00
		1.5	105.0		0.458E+09		0.630E+00		0.315E+00
		1.0	105.0		0.596E+09		0.484E+00		0.242E+00
		0.5	105.0		0.784E+09		0.368E+00		0.184E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.411E+08	0.850E+05	0.849E+04	0.280E+05	0.282E+04
		1.5	105.0		0.541E+08		0.646E+04		0.214E+04
		1.0	105.0		0.705E+08		0.497E+04		0.164E+04
		0.5	105.0		0.928E+08		0.378E+04		0.125E+04
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.286E+08	0.240E+04	0.347E+03	0.240E+04	0.347E+03
		1.5	105.0		0.377E+08		0.264E+03		0.264E+03
		1.0	105.0		0.491E+08		0.203E+03		0.203E+03
		0.5	105.0		0.646E+08		0.154E+03		0.154E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.120E+08	0.100E+05	0.401E+04	0.400E+04	0.161E+04
		1.5	105.0		0.158E+08		0.304E+04		0.122E+04
		1.0	105.0		0.206E+08		0.234E+04		0.937E+03
		0.5	105.0		0.271E+08		0.178E+04		0.712E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.947E+07	0.420E+04	0.260E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.125E+08		0.197E+04		-0.999E+01
		1.0	105.0		0.163E+08		0.151E+04		-0.999E+01
		0.5	105.0		0.214E+08		0.115E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.888E+06	0.370E+05	0.164E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.117E+07		0.130E+06		-0.999E+01
		1.0	105.0		0.153E+07		0.103E+06		-0.999E+01
		0.5	105.0		0.201E+07		0.807E+05		-0.999E+01

Table B3.17 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.100
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.365E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.465E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.584E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.728E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.163E+08	0.200E+04	0.494E+03	0.200E+04	0.494E+03
		1.5	105.0		0.208E+08		0.387E+03		0.387E+03
		1.0	105.0		0.261E+08		0.308E+03		0.308E+03
		0.5	105.0		0.325E+08		0.247E+03		0.247E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.678E+07	0.400E+04	0.267E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.865E+07		0.209E+04		-0.999E+01
		1.0	105.0		0.109E+08		0.167E+04		-0.999E+01
		0.5	105.0		0.136E+08		0.134E+04		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.496E+07	0.400E+03	0.359E+03	0.400E+03	0.359E+03
		1.5	105.0		0.633E+07		0.281E+03		0.281E+03
		1.0	105.0		0.795E+07		0.224E+03		0.224E+03
		0.5	105.0		0.992E+07		0.179E+03		0.179E+03
Napthalene	213	2.0	105.0	0.100E+01	0.890E+05	0.360E+02	0.221E+04	0.225E+02	0.138E+04
		1.5	105.0		0.114E+06		0.173E+04		0.108E+04
		1.0	105.0		0.143E+06		0.138E+04		0.862E+03
		0.5	105.0		0.178E+06		0.111E+04		0.691E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.474E+09	0.200E+05	0.910E+02	0.700E+04	0.318E+02
		1.5	105.0		0.605E+09		0.713E+02		0.250E+02
		1.0	105.0		0.759E+09		0.569E+02		0.199E+02
		0.5	105.0		0.943E+09		0.458E+02		0.160E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.272E+09	0.400E+04	0.597E+02	0.135E+04	0.201E+02
		1.5	105.0		0.347E+09		0.468E+02		0.158E+02
		1.0	105.0		0.435E+09		0.373E+02		0.126E+02
		0.5	105.0		0.542E+09		0.299E+02		0.101E+02
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.238E+08	0.180E+04	0.496E+03	0.600E+03	0.165E+03
		1.5	105.0		0.304E+08		0.389E+03		0.130E+03
		1.0	105.0		0.382E+08		0.310E+03		0.103E+03
		0.5	105.0		0.476E+08		0.248E+03		0.828E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.114E+08	0.120E+04	0.446E+03	0.400E+03	0.149E+03
		1.5	105.0		0.145E+08		0.350E+03		0.117E+03
		1.0	105.0		0.182E+08		0.279E+03		0.929E+02
		0.5	105.0		0.227E+08		0.224E+03		0.746E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.386E+09	0.700E+02	0.749E+00	0.350E+02	0.374E+00
		1.5	105.0		0.492E+09		0.587E+00		0.293E+00
		1.0	105.0		0.617E+09		0.468E+00		0.234E+00
		0.5	105.0		0.769E+09		0.375E+00		0.188E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.456E+08	0.850E+05	0.766E+04	0.280E+05	0.254E+04
		1.5	105.0		0.582E+08		0.601E+04		0.199E+04
		1.0	105.0		0.730E+08		0.480E+04		0.159E+04
		0.5	105.0		0.910E+08		0.385E+04		0.127E+04
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.317E+08	0.240E+04	0.313E+03	0.240E+04	0.313E+03
		1.5	105.0		0.405E+08		0.245E+03		0.245E+03
		1.0	105.0		0.509E+08		0.195E+03		0.195E+03
		0.5	105.0		0.634E+08		0.157E+03		0.157E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.133E+08	0.100E+05	0.361E+04	0.400E+04	0.145E+04
		1.5	105.0		0.170E+08		0.283E+04		0.114E+04
		1.0	105.0		0.213E+08		0.226E+04		0.905E+03
		0.5	105.0		0.266E+08		0.181E+04		0.726E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.105E+08	0.420E+04	0.234E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.134E+08		0.183E+04		-0.999E+01
		1.0	105.0		0.169E+08		0.146E+04		-0.999E+01
		0.5	105.0		0.210E+08		0.117E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.987E+06	0.370E+05	0.151E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.126E+07		0.122E+06		-0.999E+01
		1.0	105.0		0.158E+07		0.100E+06		-0.999E+01
		0.5	105.0		0.197E+07		0.821E+05		-0.999E+01

Table B3.18 Summary table without soil resistance.

SOURCE DIMENSION (M) = 100 X 100
ROUGHNESS OVER SOURCE (M) = 0.200
FRICTION VELOCITY (M/S) = 0.200

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.0	0.100E+01	0.400E+08	-0.100E+04	-0.999E+01	-0.100E+04	-0.999E+01
		1.5	105.0		0.494E+08		-0.999E+01		-0.999E+01
		1.0	105.0		0.596E+08		-0.999E+01		-0.999E+01
		0.5	105.0		0.702E+08		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.0	0.100E+01	0.179E+08	0.200E+04	0.450E+03	0.200E+04	0.450E+03
		1.5	105.0		0.221E+08		0.365E+03		0.365E+03
		1.0	105.0		0.266E+08		0.302E+03		0.302E+03
		0.5	105.0		0.314E+08		0.256E+03		0.256E+03
Ethylbenzene	119	2.0	105.0	0.100E+01	0.745E+07	0.400E+04	0.243E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.919E+07		0.197E+04		-0.999E+01
		1.0	105.0		0.111E+08		0.163E+04		-0.999E+01
		0.5	105.0		0.131E+08		0.139E+04		-0.999E+01
Styrene	276	2.0	105.0	0.100E+01	0.545E+07	0.400E+03	0.327E+03	0.400E+03	0.327E+03
		1.5	105.0		0.672E+07		0.265E+03		0.265E+03
		1.0	105.0		0.812E+07		0.219E+03		0.219E+03
		0.5	105.0		0.957E+07		0.186E+03		0.186E+03
Napthalene	213	2.0	105.0	0.100E+01	0.978E+05	0.360E+02	0.201E+04	0.225E+02	0.126E+04
		1.5	105.0		0.121E+06		0.163E+04		0.102E+04
		1.0	105.0		0.146E+06		0.135E+04		0.845E+03
		0.5	105.0		0.172E+06		0.114E+04		0.716E+03
Chloromethane	191	2.0	105.0	0.100E+01	0.520E+09	0.200E+05	0.829E+02	0.700E+04	0.290E+02
		1.5	105.0		0.641E+09		0.673E+02		0.236E+02
		1.0	105.0		0.773E+09		0.558E+02		0.195E+02
		0.5	105.0		0.908E+09		0.475E+02		0.166E+02
Bromomethane	190	2.0	105.0	0.100E+01	0.299E+09	0.400E+04	0.544E+02	0.135E+04	0.183E+02
		1.5	105.0		0.368E+09		0.441E+02		0.149E+02
		1.0	105.0		0.444E+09		0.366E+02		0.123E+02
		0.5	105.0		0.522E+09		0.311E+02		0.105E+02
Carbon tetrachloride	54	2.0	105.0	0.100E+01	0.262E+08	0.180E+04	0.452E+03	0.600E+03	0.151E+03
		1.5	105.0		0.323E+08		0.366E+03		0.122E+03
		1.0	105.0		0.390E+08		0.304E+03		0.101E+03
		0.5	105.0		0.459E+08		0.258E+03		0.859E+02
1,2-Dichlorethane	125	2.0	105.0	0.100E+01	0.125E+08	0.120E+04	0.407E+03	0.400E+03	0.136E+03
		1.5	105.0		0.154E+08		0.330E+03		0.110E+03
		1.0	105.0		0.186E+08		0.273E+03		0.911E+02
		0.5	105.0		0.219E+08		0.232E+03		0.774E+02
1,1-Dichloroethylene	306	2.0	105.0	0.100E+01	0.423E+09	0.700E+02	0.682E+00	0.350E+02	0.341E+00
		1.5	105.0		0.522E+09		0.553E+00		0.277E+00
		1.0	105.0		0.630E+09		0.458E+00		0.229E+00
		0.5	105.0		0.741E+09		0.389E+00		0.195E+00
Trichloroethylene	296	2.0	105.0	0.100E+01	0.501E+08	0.850E+05	0.698E+04	0.280E+05	0.231E+04
		1.5	105.0		0.617E+08		0.567E+04		0.188E+04
		1.0	105.0		0.745E+08		0.470E+04		0.155E+04
		0.5	105.0		0.877E+08		0.400E+04		0.132E+04
1,2-Dichloropropane	256	2.0	105.0	0.100E+01	0.349E+08	0.240E+04	0.285E+03	0.240E+04	0.285E+03
		1.5	105.0		0.430E+08		0.231E+03		0.231E+03
		1.0	105.0		0.519E+08		0.192E+03		0.192E+03
		0.5	105.0		0.611E+08		0.163E+03		0.163E+03
Tetracloroethylene	235	2.0	105.0	0.100E+01	0.146E+08	0.100E+05	0.329E+04	0.400E+04	0.132E+04
		1.5	105.0		0.180E+08		0.267E+04		0.107E+04
		1.0	105.0		0.218E+08		0.221E+04		0.887E+03
		0.5	105.0		0.256E+08		0.188E+04		0.752E+03
Chlorobenzene	211	2.0	105.0	0.100E+01	0.116E+08	0.420E+04	0.213E+04	-0.100E+04	-0.999E+01
		1.5	105.0		0.143E+08		0.173E+04		-0.999E+01
		1.0	105.0		0.172E+08		0.143E+04		-0.999E+01
		0.5	105.0		0.203E+08		0.121E+04		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.0	0.100E+01	0.108E+07	0.370E+05	0.139E+06	-0.100E+04	-0.999E+01
		1.5	105.0		0.134E+07		0.116E+06		-0.999E+01
		1.0	105.0		0.161E+07		0 984E+05		-0.999E+01
		0.5	105.0		0.190E+07		0.848E+05		-0.999E+01

Table B4.1 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 3
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	115.0	0.180E+02	0.168E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.0		0.225E+06		-0.999E+01		-0.999E+01
		1.0	105.0		0.294E+06		-0.999E+01		-0.999E+01
		0.5	105.0		0.378E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	115.0	0.515E+03	0.573E+05	0.200E+04	0.138E+02	0.200E+04	0.138E+02
		1.5	105.0		0.766E+05		0.103E+02		0.103E+02
		1.0	105.0		0.100E+06		0.792E+01		0.792E+01
		0.5	105.0		0.129E+06		0.615E+01		0.615E+01
Styrene	276	2.0	115.0	0.349E+02	0.482E+05	0.400E+03	0.223E+02	0.400E+03	0.223E+02
		1.5	105.0		0.644E+05		0.167E+02		0.167E+02
		1.0	105.0		0.842E+05		0.128E+02		0.128E+02
		0.5	105.0		0.108E+06		0.994E+01		0.994E+01
Napthalene	213	2.0	115.0	0.401E+04	0.303E+03	0.360E+02	0.366E+01	0.225E+02	0.229E+01
		1.5	105.0		0.405E+03		0.274E+01		0.171E+01
		1.0	105.0		0.529E+03		0.210E+01		0.131E+01
		0.5	105.0		0.682E+03		0.163E+01		0.102E+01
1,2-Dichlorethane	125	2.0	115.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.0		0.100E+11		N/A		N/A
		1.0	105.0		0.100E+11		N/A		N/A
		0.5	105.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	115.0	0.289E+02	0.137E+06	0.240E+04	0.390E+02	0.240E+04	0.390E+02
		1.5	105.0		0.183E+06		0.292E+02		0.292E+02
		1.0	105.0		0.239E+06		0.224E+02		0.224E+02
		0.5	105.0		0.308E+06		0.174E+02		0.174E+02
Chlorobenzene	211	2.0	115.0	0.488E+03	0.458E+05	0.420E+04	0.344E+02	-0.999E+03	-0.999E+01
		1.5	105.0		0.612E+05		0.257E+02		-0.999E+01
		1.0	105.0		0.800E+05		0.197E+02		-0.999E+01
		0.5	105.0		0.103E+06		0.153E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	115.0	0.145E+03	0.787E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.0		0.105E+05		N/A		-0.999E+01
		1.0	105.0		0.137E+05		N/A		-0.999E+01
		0.5	105.0		0.177E+05		N/A		-0.999E+01

Table B4.2 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.3
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	115.0	0.180E+02	0.161E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.0		0.215E+06		-0.999E+01		-0.999E+01
		1.0	105.0		0.281E+06		-0.999E+01		-0.999E+01
		0.5	105.0		0.361E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	115.0	0.515E+03	0.550E+05	0.200E+04	0.144E+02	0.200E+04	0.144E+02
		1.5	105.0		0.734E+05		0.108E+02		0.108E+02
		1.0	105.0		0.959E+05		0.826E+01		0.826E+01
		0.5	105.0		0.124E+06		0.641E+01		0.641E+01
Styrene	276	2.0	115.0	0.349E+02	0.464E+05	0.400E+03	0.232E+02	0.400E+03	0.232E+02
		1.5	105.0		0.619E+05		0.174E+02		0.174E+02
		1.0	105.0		0.809E+05		0.133E+02		0.133E+02
		0.5	105.0		0.104E+06		0.103E+02		0.103E+02
Napthalene	213	2.0	115.0	0.401E+04	0.293E+03	0.360E+02	0.379E+01	0.225E+02	0.237E+01
		1.5	105.0		0.391E+03		0.284E+01		0.177E+01
		1.0	105.0		0.511E+03		0.217E+01		0.136E+01
		0.5	105.0		0.658E+03		0.169E+01		0.105E+01
1,2-Dichlorethane	125	2.0	115.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.0		0.100E+11		N/A		N/A
		1.0	105.0		0.100E+11		N/A		N/A
		0.5	105.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	115.0	0.289E+02	0.131E+06	0.240E+04	0.409E+02	0.240E+04	0.409E+02
		1.5	105.0		0.175E+06		0.306E+02		0.306E+02
		1.0	105.0		0.228E+06		0.234E+02		0.234E+02
		0.5	105.0		0.294E+06		0.182E+02		0.182E+02
Chlorobenzene	211	2.0	115.0	0.488E+03	0.440E+05	0.420E+04	0.358E+02	-0.999E+03	-0.999E+01
		1.5	105.0		0.588E+05		0.268E+02		-0.999E+01
		1.0	105.0		0.768E+05		0.205E+02		-0.999E+01
		0.5	105.0		0.989E+05		0.159E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	115.0	0.145E+03	0.757E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.0		0.101E+05		N/A		-0.999E+01
		1.0	105.0		0.132E+05		N/A		-0.999E+01
		0.5	105.0		0.170E+05		N/A		-0.999E+01

Table B4.3 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	115.0	0.180E+02	0.202E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.0		0.270E+06		-0.999E+01		-0.999E+01
		1.0	105.0		0.353E+06		-0.999E+01		-0.999E+01
		0.5	105.0		0.455E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	115.0	0.515E+03	0.679E+05	0.200E+04	0.117E+02	0.200E+04	0.117E+02
		1.5	105.0		0.907E+05		0.873E+01		0.873E+01
		1.0	105.0		0.119E+06		0.668E+01		0.668E+01
		0.5	105.0		0.153E+06		0.519E+01		0.519E+01
Styrene	276	2.0	115.0	0.349E+02	0.567E+05	0.400E+03	0.190E+02	0.400E+03	0.190E+02
		1.5	105.0		0.757E+05		0.142E+02		0.142E+02
		1.0	105.0		0.989E+05		0.109E+02		0.109E+02
		0.5	105.0		0.127E+06		0.847E+01		0.847E+01
Napthalene	213	2.0	115.0	0.401E+04	0.351E+03	0.360E+02	0.316E+01	0.225E+02	0.198E+01
		1.5	105.0		0.469E+03		0.237E+01		0.148E+01
		1.0	105.0		0.613E+03		0.181E+01		0.113E+01
		0.5	105.0		0.789E+03		0.141E+01		0.879E+00
1,2-Dichlorethane	125	2.0	115.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.0		0.100E+11		N/A		N/A
		1.0	105.0		0.100E+11		N/A		N/A
		0.5	105.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	115.0	0.289E+02	0.165E+06	0.240E+04	0.324E+02	0.240E+04	0.324E+02
		1.5	105.0		0.221E+06		0.243E+02		0.243E+02
		1.0	105.0		0.288E+06		0.186E+02		0.186E+02
		0.5	105.0		0.371E+06		0.144E+02		0.144E+02
Chlorobenzene	211	2.0	115.0	0.488E+03	0.541E+05	0.420E+04	0.291E+02	-0.999E+03	-0.999E+01
		1.5	105.0		0.723E+05		0.218E+02		-0.999E+01
		1.0	105.0		0.944E+05		0.167E+02		-0.999E+01
		0.5	105.0		0.122E+06		0.130E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	115.0	0.145E+03	0.923E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.0		0.123E+05		N/A		-0.999E+01
		1.0	105.0		0.161E+05		N/A		-0.999E+01
		0.5	105.0		0.207E+05		N/A		-0.999E+01

Table B4.4 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = NO

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	115.0	0.180E+02	0.510E+05	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.0		0.682E+05		-0.999E+01		-0.999E+01
		1.0	105.0		0.891E+05		-0.999E+01		-0.999E+01
		0.5	105.0		0.115E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	115.0	0.515E+03	0.159E+05	0.200E+04	0.497E+02	0.200E+04	0.497E+02
		1.5	105.0		0.213E+05		0.372E+02		0.372E+02
		1.0	105.0		0.278E+05		0.285E+02		0.285E+02
		0.5	105.0		0.358E+05		0.221E+02		0.221E+02
Styrene	276	2.0	115.0	0.349E+02	0.127E+05	0.400E+03	0.851E+02	0.400E+03	0.851E+02
		1.5	105.0		0.169E+05		0.638E+02		0.638E+02
		1.0	105.0		0.221E+05		0.488E+02		0.488E+02
		0.5	105.0		0.284E+05		0.379E+02		0.379E+02
Napthalene	213	2.0	115.0	0.401E+04	0.719E+02	0.360E+02	0.154E+02	0.225E+02	0.965E+01
		1.5	105.0		0.961E+02		0.116E+02		0.722E+01
		1.0	105.0		0.126E+03		0.884E+01		0.553E+01
		0.5	105.0		0.162E+03		0.687E+01		0.429E+01
1,2-Dichlorethane	125	2.0	115.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.0		0.100E+11		N/A		N/A
		1.0	105.0		0.100E+11		N/A		N/A
		0.5	105.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	115.0	0.289E+02	0.421E+05	0.240E+04	0.127E+03	0.240E+04	0.127E+03
		1.5	105.0		0.563E+05		0.951E+02		0.951E+02
		1.0	105.0		0.735E+05		0.728E+02		0.728E+02
		0.5	105.0		0.946E+05		0.565E+02		0.565E+02
Chlorobenzene	211	2.0	115.0	0.488E+03	0.124E+05	0.420E+04	0.127E+03	-0.999E+03	-0.999E+01
		1.5	105.0		0.166E+05		0.951E+02		-0.999E+01
		1.0	105.0		0.217E+05		0.728E+02		-0.999E+01
		0.5	105.0		0.279E+05		0.565E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	115.0	0.145E+03	0.205E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.0		0.274E+04		N/A		-0.999E+01
		1.0	105.0		0.358E+04		N/A		-0.999E+01
		0.5	105.0		0.460E+04		N/A		-0.999E+01

Table B4.5 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.6
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	115.0	0.180E+02	0.275E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.0		0.367E+06		-0.999E+01		-0.999E+01
		1.0	105.0		0.479E+06		-0.999E+01		-0.999E+01
		0.5	105.0		0.617E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	115.0	0.515E+03	0.914E+05	0.200E+04	0.866E+01	0.200E+04	0.866E+01
		1.5	105.0		0.122E+06		0.649E+01		0.649E+01
		1.0	105.0		0.160E+06		0.497E+01		0.497E+01
		0.5	105.0		0.617E+06		0.386E+01		0.386E+01
Styrene	276	2.0	115.0	0.349E+02	0.759E+05	0.400E+03	0.142E+02	0.400E+03	0.142E+02
		1.5	105.0		0.101E+06		0.106E+02		0.106E+02
		1.0	105.0		0.132E+06		0.814E+01		0.814E+01
		0.5	105.0		0.170E+06		0.632E+01		0.632E+01
Napthalene	213	2.0	115.0	0.401E+04	0.466E+03	0.360E+02	0.238E+01	0.225E+02	0.149E+01
		1.5	105.0		0.623E+03		0.178E+01		0.111E+01
		1.0	105.0		0.814E+03		0.136E+01		0.853E+00
		0.5	105.0		0.105E+04		0.106E+01		0.662E+00
1,2-Dichlorethane	125	2.0	115.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.0		0.100E+11		N/A		N/A
		1.0	105.0		0.100E+11		N/A		N/A
		0.5	105.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	115.0	0.289E+02	0.224E+06	0.240E+04	0.238E+02	0.240E+04	0.238E+02
		1.5	105.0		0.300E+06		0.179E+02		0.179E+02
		1.0	105.0		0.392E+06		0.137E+02		0.137E+02
		0.5	105.0		0.504E+06		0.106E+02		0.106E+02
Chlorobenzene	211	2.0	115.0	0.488E+03	0.727E+05	0.420E+04	0.217E+02	-0.999E+03	-0.999E+01
		1.5	105.0		0.970E+05		0.162E+02		-0.999E+01
		1.0	105.0		0.127E+06		0.124E+02		-0.999E+01
		0.5	105.0		0.163E+06		0.966E+01		-0.999E+01
1,2-Dichlorobenzene	86	2.0	115.0	0.145E+03	0.124E+05	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.0		0.165E+05		N/A		-0.999E+01
		1.0	105.0		0.127E+05		N/A		-0.999E+01
		0.5	105.0		0.278E+05		N/A		-0.999E+01

Table B4.6 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 1
CAP THICKNESS (M) = 1.0
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	35.0	0.180E+02	0.587E+04	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	25.0		0.963E+04		-0.999E+01		-0.999E+01
		1.0	15.0		0.171E+05		-0.999E+01		-0.999E+01
		0.5	15.0		0.343E+05		-0.999E+01		-0.999E+01
Toluene	291	2.0	35.0	0.515E+03	0.187E+04	0.200E+04	N/A	0.200E+04	N/A
		1.5	25.0		0.308E+04		0.258E+03		0.258E+03
		1.0	15.0		0.547E+04		0.145E+03		0.145E+03
		0.5	15.0		0.109E+05		0.724E+02		0.724E+02
Styrene	276	2.0	35.0	0.349E+02	0.151E+04	0.400E+03	0.712E+03	0.400E+03	0.712E+03
		1.5	25.0		0.248E+04		0.434E+03		0.434E+03
		1.0	15.0		0.441E+04		0.244E+03		0.244E+03
		0.5	15.0		0.884E+04		0.122E+03		0.122E+03
Napthalene	213	2.0	35.0	0.401E+04	0.885E+01	0.360E+02	N/A	0.225E+02	N/A
		1.5	25.0		0.145E+02		N/A		N/A
		1.0	15.0		0.258E+02		N/A		0.269E+02
		0.5	15.0		0.517E+02		0.215E+02		0.134E+02
1,2-Dichlorethane	125	2.0	35.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	25.0		0.100E+11		N/A		N/A
		1.0	15.0		0.100E+11		N/A		N/A
		0.5	15.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	35.0	0.289E+02	0.482E+04	0.240E+04	0.111E+04	0.240E+04	0.111E+04
		1.5	25.0		0.792E+04		0.675E+03		0.675E+03
		1.0	15.0		0.141E+05		0.380E+03		0.380E+03
		0.5	15.0		0.282E+05		0.190E+03		0.190E+03
Chlorobenzene	211	2.0	35.0	0.488E+03	0.147E+04	0.420E+04	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.241E+04		N/A		-0.999E+01
		1.0	15.0		0.429E+04		0.367E+03		-0.999E+01
		0.5	15.0		0.859E+04		0.184E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	35.0	0.145E+03	0.245E+03	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.403E+03		N/A		-0.999E+01
		1.0	15.0		0.716E+03		N/A		-0.999E+01
		0.5	15.0		0.143E+04		N/A		-0.999E+01

Table B4.7 Summary table with soil resistance.

SOURCE DIMENSION (M) = 10 X 10
WASTE BED THICKNESS (M) = 1
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = NO

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	35.0	0.180E+02	0.452E+04	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	25.0		0.743E+04		-0.999E+01		-0.999E+01
		1.0	15.0		0.132E+05		-0.999E+01		-0.999E+01
		0.5	15.0		0.264E+05		-0.999E+01		-0.999E+01
Toluene	291	2.0	35.0	0.515E+03	0.141E+04	0.200E+04	N/A	0.200E+04	N/A
		1.5	25.0		0.232E+04		0.342E+03		0.342E+03
		1.0	15.0		0.412E+04		0.192E+03		0.192E+03
		0.5	15.0		0.825E+04		0.960E+02		0.960E+02
Styrene	276	2.0	35.0	0.349E+02	0.112E+04	0.400E+03	0.960E+03	0.400E+03	0.960E+03
		1.5	25.0		0.184E+04		0.585E+03		0.585E+03
		1.0	15.0		0.327E+04		0.329E+03		0.329E+03
		0.5	15.0		0.656E+04		0.164E+03		0.164E+03
Napthalene	213	2.0	35.0	0.401E+04	0.637E+01	0.360E+02	N/A	0.225E+02	N/A
		1.5	25.0		0.105E+02		N/A		N/A
		1.0	15.0		0.186E+02		N/A		N/A
		0.5	15.0		0.373E+02		0.298E+02		0.186E+02
1,2-Dichlorethane	125	2.0	15.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	15.0		0.100E+11		N/A		N/A
		1.0	15.0		0.100E+11		N/A		N/A
		0.5	15.0		0.100E+11		N/A		N/A
1,1-Dichloroethylene	306	2.0	15.0	0.500E+05	0.100E+11	0.700E+02	N/A	0.350E+02	N/A
		1.5	15.0		0.100E+11		N/A		N/A
		1.0	15.0		0.100E+11		N/A		N/A
		0.5	15.0		0.100E+11		N/A		N/A
Trichloroethylene	296	2.0	15.0	0.500E+00	0.100E+11	0.850E+05	N/A	0.280E+05	N/A
		1.5	15.0		0.100E+11		N/A		N/A
		1.0	15.0		0.100E+11		N/A		N/A
		0.5	15.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	35.0	0.289E+02	0.373E+04	0.240E+04	0.143E+04	0.240E+04	0.143E+04
		1.5	25.0		0.613E+04		0.872E+03		0.872E+03
		1.0	15.0		0.109E+05		0.491E+03		0.491E+03
		0.5	15.0		0.218E+05		0.245E+03		0.245E+03
Chlorobenzene	211	2.0	35.0	0.488E+03	0.110E+04	0.420E+04	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.181E+04		N/A		-0.999E+01
		1.0	15.0		0.321E+04		N/A		-0.999E+01
		0.5	15.0		0.643E+04		0.245E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	35.0	0.145E+03	0.182E+03	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.298E+03		N/A		-0.999E+01
		1.0	15.0		0.530E+03		N/A		-0.999E+01
		0.5	15.0		0.106E+04		N/A		-0.999E+01

Table B4.8 Summary table with soil resistance.

SOURCE DIMENSION (M) = 10 X 10
WASTE BED THICKNESS (M) = 1
CAP THICKNESS (M) = 1
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	35.0	0.180E+02	0.587E+04	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	25.0		0.963E+04		-0.999E+01		-0.999E+01
		1.0	15.0		0.171E+05		-0.999E+01		-0.999E+01
		0.5	15.0		0.343E+05		-0.999E+01		-0.999E+01
Toluene	291	2.0	35.0	0.515E+03	0.187E+04	0.200E+04	N/A	0.200E+04	N/A
		1.5	25.0		0.308E+04		0.258E+03		0.258E+03
		1.0	15.0		0.547E+04		0.145E+03		0.145E+03
		0.5	15.0		0.109E+05		0.724E+02		0.724E+02
Styrene	276	2.0	35.0	0.349E+02	0.151E+04	0.400E+03	0.712E+03	0.400E+03	0.712E+03
		1.5	25.0		0.248E+04		0.434E+03		0.434E+03
		1.0	15.0		0.441E+04		0.244E+03		0.244E+03
		0.5	15.0		0.884E+04		0.122E+03		0.122E+03
Napthalene	213	2.0	35.0	0.401E+04	0.885E+01	0.360E+02	N/A	0.225E+02	N/A
		1.5	25.0		0.145E+02		N/A		N/A
		1.0	15.0		0.258E+02		N/A		0.269E+02
		0.5	15.0		0.517E+02		0.215E+02		0.134E+02
1,2-Dichlorethane	125	2.0	15.0	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	15.0		0.100E+11		N/A		N/A
		1.0	15.0		0.100E+11		N/A		N/A
		0.5	15.0		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	35.0	0.289E+02	0.482E+04	0.240E+04	0.111E+04	0.240E+04	0.111E+04
		1.5	25.0		0.792E+04		0.675E+03		0.675E+03
		1.0	15.0		0.141E+05		0.380E+03		0.380E+03
		0.5	15.0		0.282E+05		0.190E+03		0.190E+03
Chlorobenzene	211	2.0	35.0	0.488E+03	0.147E+04	0.420E+04	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.241E+04		N/A		-0.999E+01
		1.0	15.0		0.429E+04		0.367E+03		-0.999E+01
		0.5	15.0		0.859E+04		0.184E+03		-0.999E+01
1,2-Dichlorobenzene	86	2.0	35.0	0.145E+03	0.245E+03	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	25.0		0.403E+03		N/A		-0.999E+01
		1.0	15.0		0.716E+03		N/A		-0.999E+01
		0.5	15.0		0.143E+04		N/A		-0.999E+01

Table B4.9 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 10
CAP THICKNESS (M) = 0.5
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.00	0.180E+02	0.180E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.00		0.254E+06		-0.999E+01		-0.999E+01
		1.0	105.00		0.342E+06		-0.999E+01		-0.999E+01
		0.5	105.00		0.456E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.00	0.515E+03	0.594E+05	0.200E+04	0.133E+02	0.200E+04	0.133E+02
		1.5	105.00		0.839E+05		0.944E+01		0.944E+01
		1.0	105.00		0.113E+06		0.699E+01		0.699E+01
		0.5	105.00		0.151E+06		0.525E+01		0.525E+01
Styrene	276	2.0	105.00	0.349E+02	0.491E+05	0.400E+03	0.219E+02	0.400E+03	0.219E+02
		1.5	105.00		0.694E+05		0.155E+02		0.155E+02
		1.0	105.00		0.936E+05		0.115E+02		0.115E+02
		0.5	105.00		0.125E+06		0.864E+01		0.864E+01
Napthalene	213	2.0	105.00	0.401E+04	0.300E+03	0.360E+02	0.370E+01	0.225E+02	0.231E+01
		1.5	105.00		0.424E+03		0.262E+01		0.164E+01
		1.0	105.00		0.572E+03		0.194E+01		0.121E+01
		0.5	105.00		0.761E+03		0.146E+01		0.911E+00
1,2-Dichlorethane	125	2.0	105.00	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.00		0.100E+11		N/A		N/A
		1.0	105.00		0.100E+11		N/A		N/A
		0.5	105.00		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	105.00	0.289E+02	0.147E+06	0.240E+04	0.364E+02	0.240E+04	0.364E+02
		1.5	105.00		0.207E+06		0.258E+02		0.258E+02
		1.0	105.00		0.280E+06		0.191E+02		0.191E+02
		0.5	105.00		0.373E+06		0.144E+02		0.144E+02
Chlorobenzene	211	2.0	105.00	0.488E+03	0.471E+05	0.420E+04	0.334E.02	-0.999E+03	-0.999E+01
		1.5	105.00		0.666E+05		0.237E+03		-0.999E+01
		1.0	105.00		0.898E+05		0.175E+03		-0.999E+01
		0.5	105.00		0.120E+06		0.132E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.00	0.145E+03	0.799E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.00		0.113E+05		N/A		-0.999E+01
		1.0	105.00		0.152E+05		N/A		-0.999E+01
		0.5	105.00		0.203E+05		N/A		-0.999E+01

Table B4.10 Summary table with soil resistance.

SOURCE DIMENSION (M) = 100 X 100
WASTE BED THICKNESS (M) = 5
CAP THICKNESS (M) = 0.5
POROSITY OF SOIL = 0.5
POROSITY OF WASTE = 0.5
BAROMETRIC PUMPING = YES

CHEMICALS	AQ_NO	HTS (M)	XP (M)	MASS FRAC. MODEL	MAX. CON (UG/M3)	...1/2 HR...		...24 HR...	
						AQC (UG/M3)	SOIL CCNC (ppmm	FQC UG/M3)	SOIL CCNC (ppmm)
Benzene	21	2.0	105.00	0.180E+02	0.126E+06	-0.999E+03	-0.999E+01	-0.999E+03	-0.999E+01
		1.5	105.00		0.178E+06		-0.999E+01		-0.999E+01
		1.0	105.00		0.240E+06		-0.999E+01		-0.999E+01
		0.5	105.00		0.320E+06		-0.999E+01		-0.999E+01
Toluene	291	2.0	105.00	0.515E+03	0.410E+05	0.200E+04	0.193E+02	0.200E+04	0.193E+02
		1.5	105.00		0.579E+05		0.137E+02		0.137E+02
		1.0	105.00		0.782E+05		0.101E+02		0.101E+02
		0.5	105.00		0.104E+06		0.761E+01		0.761E+01
Styrene	276	2.0	105.00	0.349E+02	0.335E+05	0.400E+03	0.321E+02	0.400E+03	0.321E+02
		1.5	105.00		0.474E+05		0.228E+02		0.228E+02
		1.0	105.00		0.639E+05		0.169E+02		0.169E+02
		0.5	105.00		0.851E+05		0.127E+02		0.127E+02
Napthalene	213	2.0	105.00	0.401E+04	0.201E+03	0.360E+02	0.553E+01	0.225E+02	0.345E+01
		1.5	105.00		0.284E+03		0.391E+01		0.244E+01
		1.0	105.00		0.383E+03		0.290E+01		0.181E+01
		0.5	105.00		0.510E+03		0.218E+01		0.136E+01
1,2-Dichlorethane	125	2.0	105.00	0.500E+00	0.100E+11	0.120E+04	N/A	0.400E+03	N/A
		1.5	105.00		0.100E+11		N/A		N/A
		1.0	105.00		0.100E+11		N/A		N/A
		0.5	105.00		0.100E+11		N/A		N/A
1,2-Dichloropropane	256	2.0	105.00	0.289E+02	0.103E+06	0.240E+04	0.518E+02	0.240E+04	0.518E+02
		1.5	105.00		0.146E+06		0.367E+02		0.367E+02
		1.0	105.00		0.197E+06		0.272E+02		0.272E+02
		0.5	105.00		0.262E+06		0.204E+02		0.204E+02
Chlorobenzene	211	2.0	105.00	0.488E+03	0.324E+05	0.420E+04	0.487E.02	-0.999E+03	-0.999E+01
		1.5	105.00		0.457E+05		0.345E+02		-0.999E+01
		1.0	105.00		0.617E+05		0.256E+02		-0.999E+01
		0.5	105.00		0.822E+05		0.192E+02		-0.999E+01
1,2-Dichlorobenzene	86	2.0	105.00	0.145E+03	0.545E+04	0.370E+05	N/A	-0.999E+03	-0.999E+01
		1.5	105.00		0.770E+04		N/A		-0.999E+01
		1.0	105.00		0.104E+05		N/A		-0.999E+01
		0.5	105.00		0.138E+05		N/A		-0.999E+01

Appendix B.3: Rationale for MOEE Ecotoxicity-Based Soil Criteria.

Appendix B.3

This appendix replaces the rationale which was the basis for the 1989 ecotoxicity-based soil remediation criteria. The original rationale is described in the 1991 MOE publication entitled "Soil Clean-up Guidelines for Decommissioning of Industrial Lands: Background and Rationale for Development". Those parameters in the original rationale, which were based on human health effects, have been removed. A rationale for a boron soil criterion (hot water extract), based on protection of vegetation and grazing animals, has been added.

All relevant information applicable to MOEE ecotoxicity-based soil values utilized in the 1995 soil remediation criteria development process are contained in the following sections. As more information on these and other soil parameters becomes available, the information will be included in this appendix as part of the rationale for deriving ecotoxicity criteria for soil remediation.

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1 BACKGROUND

In February, 1984, the Phytotoxicology Section was requested by the Halton-Peel District Office of the MOE to provide input into the development of soil criteria for the decommissioning of certain oil refinery lands. Proposed land uses made it desirable to have separate criteria for residential and industrial redevelopment. Monenco Consultants, on behalf of one of the oil companies, undertook a large-scale literature survey in an attempt to relate contaminant concentrations in soil to toxic effects on vegetation and animals. As a result of this effort, Monenco recommended site-specific ecotoxicity-based soil criteria for a number of contaminants (Monenco Ontario Ltd., 1984a & 1984b).

Subsequent to the above-described exercise, the Phytotoxicology Section was asked to recommend soil clean-up criteria for additional contaminants. Provisional criteria for these additional elements were developed, based on literature reviews. The Phytotoxicology Section was requested by the MOE Waste Management Branch to develop clean-up levels for agricultural land use. This request was brought to the attention of the Sludge and Waste Utilization Committee. It was the opinion of this Committee that the residential/parkland clean-up levels previously developed were, with minor modifications/qualifications, also suitable for application to agricultural situations.

2 RATIONALES FOR ECOTOXCITY-BASED SOIL CRITERIA

The recommended ecotoxicity-based soil remediation criteria are shown in Section 5.1 (Table 5.1). The rationales for their development include considerations of phytotoxicity and animal health. In general, the most conservative of these considerations was used to established agricultural and residential soil criteria. Redevelopment as parkland also was felt to warrant this conservative approach, because parkland often is used by children at play, and occasionally is used for allotment gardening.

Different industrial/commercial remediation levels (normally set at twice the residential levels) were recommended where the residential and industrial criteria were both set on the same basis but where phytotoxic concerns were judged to be considerably less significant in the industrial/commercial environment. For two elements (molybdenum and selenium), residential soil remediation levels were established to prevent toxicity to grazing animals, whereas a higher industrial level was established to prevent toxicity to vegetation.

Provisional ecotoxicity-based soil remediation criteria recommended for four additional contaminants are shown in Section 5.2 (Table 5.2). Because knowledge of potential adverse effects of these elements in soil is generally more limited than for the Table 1 criteria, the provisional criteria were purposefully established in an even more conservative vein.

Since the mobility and availability of metals in soils may be highly dependent on form of the metal, soil texture, pH and organic matter content, site-specific considerations of these parameters may reveal the suitability of different criteria. For example, where metals are known to be present in specific forms of very limited availability, higher levels may be considered. Furthermore, in researching the clean-up criteria, Monenco Consultants utilized data from studies on medium to fine textured soils (i.e. sandy soils excluded), in which mobility (availability) of metals would be lower than in coarse-textured sand (hence, metals are less likely to accumulate in sand than in clay). Therefore, it is recommended that the remediation levels for the metals and metalloids be reduced in the case of coarse-textured (greater than 70% sand) mineral soils (less than 17% organic matter). This recommendation is reflected in the remediation levels shown in Tables 5.1 and 5.2.

The rationales for individual parameters are summarized in the following sections. Concentrations are given as ppm (ug/g), dry weight, unless otherwise indicated.

2.1 Arsenic (As)

- arsenic is essential to mammals and algae (Bowen, 1979) but essentiality to higher plants has not been confirmed (Kabata-Pendias and Pendias, 1984)
- the toxicity of arsenic to plants and animals is well documented, although it is not classified as a cumulative poison in man (NAS, 1977)
- the Phytotoxicology Section "upper limit of normal" arsenic guideline for urban Ontario surface soils is 20 ppm (MOE, 1989a)
- it is generally agreed that the main problem caused by excessive arsenic in soils is phytotoxicity rather than accumulation by crops of arsenic levels toxic to animals and man, because significant phytotoxic effects occur at lower arsenic levels in plants than do health effects (Jacobs et al., 1970; Peterson et al., 1981)
- arsenic levels in plant tissue reported as phytotoxic are: 5 - 20 ppm (Kabata-Pendias and Pendias, 1984); 20 ppm (Davis et al., 1978); 0.5 - 230 ppm (reported in NRCC, 1978); 3 - 10 ppm (Chaney, 1982)
- the limit set for arsenic in food crops in the U.S. is 2.6 ppm, fresh weight (U.S. Public Health Service, reported in Peterson et al. 1981), equivalent to approx. 13 to 52 ppm on a dry weight basis
- Kirkpatrick (1981) has stated that arsenic levels in fruits and vegetables above 1 ppm, fresh weight (equivalent to 5-20 ppm, dry weight, depending on moisture content) may pose a potential danger to health from long-term consumption

- the Phytotoxicology Section (unpublished results) has found average arsenic levels in fresh vegetables of 0.17 ppm (equivalent to 0.85 - 3.4 ppm, dry wt.) at average soil arsenic levels of 61 ppm

- NAS (1980) has established 50 ppm (dry wt.) arsenic as the maximum dietary concentration chronically tolerated by livestock

- phytotoxicity of arsenic in soil is dependent upon soil texture (as with most metals) and upon form of arsenic, with highly water-soluble forms of arsenic being more toxic than less soluble forms (Peterson et al., 1981)

- toxicity of soil arsenic decreases in the order: arsenite > arsenate > organic arsenicals (MSMA,CA) (Peterson et al., 1981)

- however, regardless of the form in which the arsenical is applied, it is apparently eventually oxidized and metabolized to arsenate (Woolson, 1973)

- Walsh and Keeney (1975) have established that a critical range of total arsenic in soils at which reduced crop yields may occur is 25 - 85 ppm

- a review of the literature given in NRCC (1978) generally supports a minimum total soil arsenic phytotoxic level of 25 ppm, with effects at low levels being restricted to sensitive plants such as legumes and rice

- a maximum allowable phytotoxicity-based limit of arsenic in paddy soils of 15 ppm has been proposed in Japan (cited in Kabata-Pendias and Pendias, 1984) (availability of arsenic is increased in wet (reduced) soils (Peterson et al., 1981))

- Ontario Ministry of the Environment investigations (unpublished) on former mine tailings areas have found no adverse effects on plants of 200 ppm or more of arsenic (as arsenic trioxide) in soil

- Anderson et al. (1983) recommended a maximum soil arsenic level of 300 ppm at closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for arsenic of from 30 to 50 ppm

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable arsenic level in sludged agricultural soils of 14 ppm.

Recommendation: **Soil As concentrations should be <25 ppm for agricultural and residential/parkland land use categories and <50 ppm for industrial/commercial land use.**

* Unless stated otherwise, residential soil criteria also apply to agricultural and parkland situations; while industrial soil criteria also apply to commercial situations

2.2 Boron (B)

2.2.1 Introduction

At present, the existing guidelines for the clean-up and decommissioning of sites in Ontario do not have a criterion for boron (OME, 1989a). The upper limit of normal concentration of boron in Ontario surface soils is 15 mg B kg^{-1} in urban areas and 10 mg B kg^{-1} in rural areas (MOEE, 1989b). A recent sampling program indicates that the 98th percentile of the Ontario Typical Range distributions is 30 mg kg^{-1} for both rural and urban parkland categories (MOEE, 1993). The MOEE provincial drinking water objectives allow up to 5 mg l^{-1} of B in the drinking water. It has been suggested that at levels of about 30 mg l^{-1} and above, interferences with digestive processes may occur (Adriano, 1986). Toxicologically, boron content in foodstuffs is not of great concern compared to other trace elements. Only at an excessively high intake of 4000 mg per day and higher can boron be proved toxic. In the past, boric acid, $B(OH)_3$, had been used as a food preservative, but now this use is considered unacceptable by FAO/WHO (the United Nation's Food and Agricultural Organization and the World Health Organization) (Adriano, 1986). Under certain circumstances, however, boron contamination from a point source may pose toxic problems for plants and even grazing animals.

The objectives of the following literature review on boron were: (1) to fully document the available data on B toxicity to plants and (2) to determine a boron soil criteria for boron for the remediation of sites in Ontario.

2.2.2 Boron in Soil-Plant Systems

Boron is a naturally occurring material which is released into the environment through weathering processes. It is used in a wide range of industrial and domestic products, including fibreglass, detergents, and fertilizers. Boron is one of the seven recognized essential micronutrients required for the normal growth of most plants, but it apparently does not play a role in the metabolic processes in animals.

Total B concentrations in soils can vary from 20 to 200 mg B kg^{-1} (Berger and Pratt, 1963). Generally, less than 5% of total soil B is found in plant available forms (Gupta, 1979). The adsorption of B on oxides of Fe and Al is believed to be an important mechanism governing B solubility in soils and clays (Sims and Bingham, 1986a, 1986b). Boron is unique among the essential nutrient elements for plants because it is the only element that is normally present in soil solution as a non-ionized molecule over the pH range suitable for plant growth. Molecular boric acid (H_3BO_3) is the form of B that plant roots absorb most efficiently (Oertli and Grgurevic, 1975).

To assess the amount of plant available B in soils, different procedures have been developed. To date, hot water soluble B and saturation extract B are considered to be the best indicators for predicting plant responses to soil B. Most of the soil B data in the literature are given as hot water soluble B (HWS-B).

B deficiency in plants is more widespread than deficiencies of other micronutrients because, once B is released from soil minerals, it can be leached from the soil fairly rapidly in its non-ionic forms. For this reason, light textured soils in high rainfall areas are often deficient in boron. Boron is highly toxic to plants when it exists at high levels in soils. In nature, however, B toxicity is not as widespread as B deficiency. Toxicity can occur under the following conditions:

(1) in soils inherently high in B, or in which B has naturally accumulated;
(2) as a result of over-fertilization with minerals with a high B concentration;
(3) through use of irrigation waters high in B, leading to B accumulation in soil;
(4) through contamination of soils near some industrial facilities (Palmer and Linzon, 1981; Temple and Linzon, 1976; Severson and Gouch, 1983; Hayden, 1981) as well as;
5) overloading soils with municipal waste waters (Neary et al. 1975), certain industrial waste water (Hutchinson and Viets, 1969), or high B compost (Purves and MacKenzie, 1973; Gupta et al., 1973; Gogue and Sanderson, 1973).

The biochemical role of B in plants is still not well understood and, unlike other micronutrients, it has not been shown to be part of an enzyme system. There is evidence that B is important in cell division and is apparently a necessary component of the cell wall. Boron also plays an important role in the pyrimidine biosynthetic pathways, translocation of sugar, in water relations in the protoplasm, in the production of pectin, in the absorption of calcium, and in maintaining the activity of ATPase (Sauchelli, 1969; Gupta, 1979, 1985).

Among the known essential nutrient elements, B requires special attention because the tissue concentration range between deficiency and toxicity is very narrow in many important crops. For most plant species which are sensitive to B deficiency, symptoms of B deficiencies in the field occur when B levels in plants is less than 15 mg B kg^{-1} (dry weight basis), while B concentrations of 20-100 mg B kg^{-1} are sufficient for most plant growth.

Boron toxicity under field conditions generally occurs when plant tissue concentration exceeds a critical limit (Table 2.1), but different plant species vary greatly in their tolerance to excessive B (Table 2.2). Monocotyledons generally require less B than dicotyledons with members of the *Papilionaceae* (especially the *Leguminosae*) and the *Cruciferae* usually requiring the highest levels of B (Berger, 1949). Root crops, such as sugar beets, radish, carrots and rutabaga are among the most responsive to B fertilization when soil B is relatively low.

The symptoms of B toxicity are similar in most plants. Affected plants show marginal and tip chlorosis which is quickly followed by necrosis. The pattern of chlorosis and necrosis follows the leaf venation because B in plants is transported through xylem and, therefore, has a tendency to accumulate at the margins or tips of leaves. Symptoms of B toxicity on some important crops are given in Section 2.2.6.

2.2.3 Establishment of a Boron Database

The scientific literature was first searched for articles on boron dating back to 1985. Some papers published before 1985 were later included if they were cited in the papers after 1985 and were deemed to be good 'B effects' papers. It was assumed that most of the earlier important papers on boron would be cited in recent publications on B, especially in recent review papers, and would not be overlooked. The B database was constructed in DBASE III Plus and has 21 data fields and a total of 2267 entries. In the database, there are no total soil B concentration data in any of the 2267 entries, with 316 entries from solution culture experiments. Of the 1957 entries with soil extractable B data, 1572 entries have hot water soluble B (HWS-B) data and 245 entries are as saturation extract B. The B database contains 40 different plant species (shaded area in Table 2.2), which include sensitive, semi-tolerant and tolerant species. Among these 40 species, there are many important crops species that are common in Ontario. Lacking in the database is information on the very sensitive fruit species (e.g. cherry, peach, blackberry and grape).

2.2.4 Approaches to Develop a Boron Soil Cleanup Criterion

As previously stated in Section II, different plant species vary greatly in their tolerance to excessive B in soils (Table 2.1 and Table 2.2). Toxic tissue B concentrations vary approximately from 16 to 800 mg B kg^{-1}. It should be noted that toxic tissue B levels in sensitive species (e.g. 16 mg B kg^{-1} for boot stage wheat shoots) are less than tissue B concentrations causing B deficiency in tolerant species (Tissue B of 30 to 40 mg B kg^{-1} in rutabaga leaves is moderately deficient). It is, therefore, not possible to find a critical tissue B concentration which is universally applicable to different plant species. It is also not practical to generate a criterion for every species because there are not enough data for each individual species.

From the above discussion, it would be inappropriate to conduct regression analyses on the combined data of different species to construct predictive models. Other approaches must be taken to develop a B remediation guideline.

The following procedures were used:

(1) A 10 to 30% yield reduction (grain, fruit, tuber yield, or plant dry weight), or visible symptoms of B toxicity were used as criteria. This requirement is intended to assure that the data represent the first occurance of meaningful toxicity symptoms, and that the data selected represent neither trivial or spurious results, nor serious effects well past the initiation of symptoms. Soil B (hot water soluble, HWS-B) and plant tissue B data, at the first occurrence of B toxicity, were extracted from the B database for all the species;

(2) The lowest, toxic soil HWS-B level for commonly occurring sensitive species was compared with the highest, deficient soil HWS-B for commonly occurring species. If these two values were similar, a compromised soil HWS-B level could be determined as the remediation criterion for B. The resulting value would not be toxic to most of the commonly occurring sensitive species and at the same time, would not be deficient to most of the commonly occurring tolerant species; and

(3) The generated critical soil B and plant tissue B concentrations were then compared with toxic B levels to grazing animals for any possible adjustment.

2.2.5 Results and Conclusion

1. Data Extracted from the Database and Other Sources

a) Tolerance of Different Plant Species to Excess B

Different plant species, even different genotypes within the same species, show marked variance in the tolerance to excessive amount of available boron in soils (Table 2.2). The B concentrations which group plant species in Table 2.2 are the threshold concentration range of B in soil solution at the soil water content of field capacity. The threshold concentration is defined as the maximum B concentration in soil solution that a given plant species tolerates without manifesting visual injury symptoms and/or a decrease in yield (Maas, 1984). Many fruit tree species are among the most sensitive species, e.g. lemon, avocado, peach, plum and orange. Beans are also very sensitive to excessive B. Grasses and the tuber species, (e.g. sudangrass, beets and alfalfa) are among the tolerant species. It should be noted that, according to different sources, some species are not consistently in the same group. For instance, pear was listed as a tolerant species by Maas (1984) but as a sensitive species by Gupta (1985), whereas onion was listed in the opposite way.

b) Toxic and Deficient Soil and Plant B Concentrations

Data presented in Table 2.3 are soil B (HWS-B) data and plant tissue B concentrations at the first occurrence of B toxicity, either by a 10 to 30% yield reduction or by the visual symptoms, in different plant species. The data indicate that the lowest toxic concentration of soil HWS-B is about 1 mg B kg^{-1} for beans (*Phaseolus vulgaris*), one of the commonly occurring sensitive species, while the toxic HWS-B levels for semi-tolerant and tolerant species is generally greater than 2.0 mg B kg^{-1}.

Results presented in Table 2.4 show the relationship between the severity of foliar injury in Norway maple and HWS-B concentrations in the surface soil in Ontario. Where soil HWS-B is lower than 1.0 mg B kg^{-1}, there was no injury on maple foliage. Foliar injury ranged from trace amounts to about 15% when HWS-B was between 1.0 to 2.0 mg B kg^{-1}. In two cases where HWS-B in surface soils were 1.4 and 1.5 mg B kg^{-1}, respectively, there was only a trace amount of foliar injury. In another case, however, maple plants suffered from trace to light foliar injury even though soil HWS-B was 1.2 mg B kg^{-1}. When soil HWS-B was above 2.0 mg B kg^{-1}, there was severe foliar injury on maple foliage.

Deficient soil and plant B concentrations, causing either a 10 to 30% yield reduction or visual symptoms of B deficiency, are presented in Table 5. The highest soil HWS-B level at which B deficiency occurred in plants was 1.78 mg B kg^{-1} (*Spinacia oleracea*), with 1.48 mg B kg^{-1} as the second highest (*Solanum tuberosum*).

In the above tables, variances of soil HWS-B levels for either B toxicity or B deficiency were both very large (Table 2.3 and Table 2.5), as shown by the large standard errors of the means. This was probably due to variation in soil properties and growth conditions of different studies, since the means of HWS-B for each plant species were averaged across different sources of soil HWS-B data (i.e. different papers in the literature).

c) Toxicity of Boron to Grazing Animals

Some available data of B toxicity to grazing animals are summarized in Table 2.6. Sheep have been found to develop enteritis when exposed to high B soils (30 to 300 mg B kg^{-1} total soil B) and associated water B levels of 1-20 mg B $liter^{-1}$, or had been fed on a daily feed that contained 40 mg B kg^{-1} (Table 2.6). It is thought that the ingestion of high concentrations of B causes reduction in intestinal proteolytic enzyme activity and blood nitrogen level. Boron, however, is less likely to produce fatal effects than are other trace elements, such as Cu.

At the low end of sufficient ranges of tissue B concentrations for normal plant growth, plant B would not pose a significant hazard to sheep. At the high end, however, some plants may be toxic to grazing sheep, e.g. timothy and alfalfa (Table 2.1). Therefore, when grown on high B soils, timothy and alfalfa are not suitable for sheep feeds or for grazing. In areas around a point source of B contamination, there is a potential for B toxicity to grazing sheep even though soil B levels are not high enough to cause B toxicity in most plant species (Table 2.1).

The U.S. EPA proposed that 5 mg B liter^{-1} should be set as the maximum safe level of B in livestock drinking water, whereas Green and Weeth (1977) and Weeth et al. (1981) proposed that the safe B level should be raised to 40 mg B liter^{-1}. They found that there were no overt signs of toxicosis in heifers when exposed to 120 mg B liter^{-1} and estimated that the safe tolerance level would be within the range of 40 to 150 mg B liter^{-1}.

2. Development of Boron Soil Criteria on the Basis of Phytotoxicity

Since there is a great variance in responses to excessive B among different plant species, it is not possible to define a universally applicable critical B level in plants (refer to Sections 2.2.2 and 2.2.4). In addition, development of a relatively low remediation criterion based on B toxicity to sensitive plant species would create the risk of producing B deficiency in many other less sensitive plant species. It would be unreasonable to require remediation of soils to boron concentrations at which significant boron deficiencies in plants could be expected in commonly occurring species.

After remediation of a B contaminated site for future agricultural or residential uses, soil B concentration in the surface soil should be at such concentrations that it is neither toxic to the most sensitive plant species, nor deficient in the most tolerant species that are commonly grown in the area. From the results presented in the above two sections, it was not possible to select a soil HWS-B level that could fit both of the above requirements. Therefore, a soil hot water soluble B concentration of 1.5 mg kg^{-1} is recommended as the B remediation criterion in Ontario for agricultural and residential land use categories. At this soil B level, neither severe B toxicity to sensitive species nor severe B deficiency in tolerant species should occur. Some tree species, such as Norway maple, may suffer trace to very light foliar injury at the 1.5 mg B kg^{-1} soil B level, while other species, such as spinach, may show some slight symtoms of B deficiency.

Discussion in Section 2.2.2 indicates that grasses can normally tolerate higher B levels, whereas data presented in Table 2.4 show that at a soil HWS-B level of less than 2.0 mg B/kg, maple trees suffer only trace to light foliar injury. These facts suggest that for future industrial land usage where a vegetative cover of grasses and trees is common, the remediation criterion could probably be placed at 2.0 mg B/kg (HWS-B). It should be noted that tree species here do not include those sensitive fruit species which are listed in Table 2.2.

Recommendation: Where there is suspicion of B contamination and B toxicity, determination of hot water soluble B (HWS-B) in soils should be requested. Soil HWS-B should be less than 1.5 mg B kg^{-1} soil for agricultural or residential/parkland land use categories, and less than 2.0 mg B kg^{-1} soil for industrial/commercial land use.

2.2.6 Additional Information - Summary of Boron Toxicity Symptoms*

1. Vegetable Crops

a. Rutabaga. The leaf margins are yellow in color and tend to curl and wrinkle. The symptoms on roots are similar to moderate B-deficiency symptoms; that is, water-soaked appearance of the tissues in the center of the root. Boron toxicity in turnip seedlings results in marginal bleaching of the cotyledons and first leaves.

b. Peas. Boron toxicity results in burning of the edges of old leaves. The extent of burning in the upper leaves depends on the degree of B toxicity.

c. Onions. Boron toxicity produces the burning of the tips of leaves, gradually increasing up to the base, and no development of the bulb.

d. Radishes. Boron excess in characterized by marginal yellowing and burning of lower leaves. The new seasons growth of radishes left in the ground over winter turn yellow.

e. Tomatoes. Boron toxicity results in dying off of older leaves.

2.Forage Crops

f. Alfalfa. Boron toxicity is marked by burned edges on the older leaves.

g. Red Clover. Toxicity symptoms of B include burning and yellowing of older leaf edges.

h. Birdsfoof trefoil. Growth is poor and leaves are small and dark with thin stems.

3. Cereal Crops

i. Wheat. Boron toxicity in wheat appears as light browning of older leaf tips converging into light greenish-blue spots.

j. Barley. Typical symptoms of B toxicity are elongated, dark-brown blotches at the tips of the older leaves. Severe browning, spotting, and burning of older leaf tips occurs, gradually extending to the middle portion of the leaf.

k. Oats. Toxicity of B in oats results in light-yellow bleached leaf tips.

l. Corn. Leaves show tip and marginal burning and yellowing between the veins.

4. Other Crops

m. Tobacco. Boron toxicity is characterized by brown circular spots on the periphery of the leaves and stunted growth.

n. Beans. Excess B causes mottled and necrotic areas on the leaves, especially along the leaf margins.

o. Blackeye Bean (Vigna unguiculata). Boron toxicity does not produce any characteristic pattern, yellowing or dead areas occur between veins.

p. Indian Bean. Slight chlorosis is caused by excess B, followed by dark-brown spots on the leaves. Marginal scorching is found on the periphery of the leaves and stunted growth occurs.

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* after Gupta, 1979.

2.2.7 Recommended Extracting Procedures of Hot Water Extractable Soil Boron

The following is the commonly adapted, modified Berger and Truog procedures for extracting hot water soluble B in soils (Gupta, 1967):

1. Weigh out twenty-five-gram samples of air-dry soil that have passed through a 2-mm sieve in 150-ml-capacity pyrex (or other low-B glass) beakers;

2. Add fifty ml of double distilled water to each beaker and stir the contents well. A beaker containing only water serves as a blank. Weigh beaker and contents;

3. Cover each beaker with a watch-glass, heat the beakers on a hot plate, and bring the contents to boiling. Keep the contents boiling on the hot plate for 5 minutes (Occasionally, when frothing is intense, a slight removal of watch-glasses for 1 or 2 seconds reducing frothing);

4. Weigh the beaker with contents after boiling and make up the loss in weight by adding double-distilled water;

5. Allow to cool for a period of 5 to 10 minutes, stir well and filter with two Whatman No. 42 filter papers. The resulting filtrate should be clear and ready for boron analysis.

Instead of distilled water, 0.01 M $CaCl_2$ can be used to extract the hot water soluble boron from soils. The advantage of $CaCl_2$ solution is that it can prevent the dispersion of soil colloids and make the filtration easier and the resulting filtrate more clear.

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2.2.8 References (for Boron criterion)

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Table 2.1 Deficient, Sufficient and Toxic Levels of Boron in Plants*

Plant Species	Plant Tissues	Growth Stage	Plant B (mg B/kg)		
			Deficient	Sufficient	Toxic
Winter Wheat (Triticum aestivum)	shoot	when plants 40 cm high	<0.3	2.1-10.1	>10a
Wheat (Triticum aestivum)	shoot	boot stage	2.1-5.0	8	>16
	straw	maturity	4.6-6.0	17	>34
Barley (Hordeum vulgare)	shoot	boot stage	1.9-3.5	10	>20
	straw	maturity	7.1-8.6	2.1	>46
Oats (Avena sativa)	shoot	boot stage	<1	8-30	>30a
	shoot	boot stage	1.1-3.5	6-15	>35
	shoot	boot stage		15-50	44-400
	shoot	47-day old plants			>105
Kidney Beans (Phaseolus vulgaris)	pods			28	43
	leaves and stems			44	132
Cauliflower (Brassica oleracea	whole tops	before curd appearance	3	12-23	
variety Botrytis)	leaves		23	36	
	leaves	when 5% heads formed	4-9	11-97	
Broccoli (Brassica oleracea	leaves			70	
variety italica Planck.)	leaves	when 5% heads formed	2-9	10-71	
Brussels Sprout (Brassica oleracea	leaves	when sprouts begin to form	6-10	13-101	
variety gemmifera Zenker)					
Red Clover (Trifolium pratense)	shoot	bud stage	12-20	21-45	>59
	shoot	one-third at bloom		20-60	>60a
Potatoes (Solanum tuberosum)	full first leaf	75 days after planting	<15.0	21-50	>50a
	shoot	32-day old plants		12	>180
Birdsfoot trefoil (Lotus corniculatus)	shoot	bud stage	14	30-45	>68
Corn (Zea mays)	ear-leaf	tassel stage		10.0b	
	shoot	until ear formation	<9.0	15-90	>100
Timothy (Phleum pratense)	shoot	heading stage		3-93	>102
Tomatoes (Lycopersicon esculentum)	shoot	63-day old plants			>125
	whole plants		14-32	34-96	91-415
	mature top leaves		<10	30-75	>200
Alfalfa (Medicago sativa)	shoot	10% bloom	8-12	39-52	>99
	top one-third of plants	shortly before flowering	<20	31-80	>100

(Table 2.1 continued next page)

(Table 2.1 continued)

	shoot	early bloom	<15	20-40	200
				15-20a	
	top of shoots	early flowering		30b	
	whole tops		<15	15-20	200
	whole tops		<20		
White pea beans (Phaseolus spp.)	shoot	30 days after planting		36-94	144
Beans (Phaseolus vulgaris)	shoot	43-day old plants		12	>160
Carrots (Daucus carota)	mature leaf lamina		<16	32-103	175-307
	leaves		18		
Peanuts (Arachis hypogaea)	young leaf tissue	30-day old plants		54-65	>250
				18-20b	
Rutabaga (Brassica napobrassica)	leaf tissue	at harvest (of tubers)	20-38	38-140	>250
			<12SD		
	leaf tissue	when roots begin to swell	32-40MD	40	
			<12SD		
	roots		<8SD	13	
Cucumber (Cucumis sativus)	mature leaf from	2 wks after first picking	<20.0	40-120	>300
	center of stem				
Celery (Apium graveolens)	leaflets		20	68-432	720
	petioles		16	28-75	
Pasture Grass	shoot	first bloom at first cut		10-50	>800
Sugar Beets (Beta vulgaris)	leaf blades	recently matured leaves	12-40	35-200	
	full middle leaf		<20	31-200	>800

* After Gupta, 1979; a: Considered to be high; b: Considered to be critical; SD: Severely Deficient; MD: Moderately Deficient.

Table 2.2 Relative Tolerance of Different Plant Species to Boron⁺

Sensitive Species	Semi-tolerant Species	Tolerant Species
(0.3 to 0.5 mg B /kg soil)	**(1.0 to 2.0 mg B /kg soil)**	**(4.0 to 6.0 mg B /kg soil)**
Lemon (Citrus limon)	Sesame (Sesamum indicum)	Sorghum (Sorghum bicolor)
Blackberry (Rubus spp.)		Alfalfa (Medicago sativa)
(0.5 to 0.8 mg B/kg soil)	Red Pepper (Capsicum annum)	Purple Vetch (Vicia benghalensis)
Avocado (Persea americana)	Pea (Pisum sativum)	Oat (Avena sativa)
Orange (Citrus sinensis)	Carrot (Daucus carota)	Parsley (Petroselium crispum)
Grapefruit (Citrus paradise)	Radish (Raphanus sativus)	Red Beet (Beta vulgaris)
Apricot (Prunus armeniaca)	Potato (Solanum tuberosum)	Tomato (Lycopersicon esculentum)
Peach (Prunus persica)	Cucumber (Cucumis sativus)	Sugar Beet (Beta saccharifera)
Cherry (Prunus avium)	**(2.0 to 4.0 mg B/kg soil)**	**(6.0 to 10.0 mg B/kg soil)**
Plum (Prunus domestica)	Lettuce (Lactuca sativa)	Cotton (Gossypium hirsutum)
Persimmon (Japanese) (Diospysos kaki)	Cabbage (Brassica oleracea)	(Gossypium herbaceum-Elawa)
Fig (Ficus carica)	Celery (Apium graveolens)	**(10.0 to 15.0 mg B/kg soil)**
Grape (Vitis vinifera)	Turnip (Brassica rapa)	Asparagus (Asparagus officinalis)
Walnut (Juglans regia)	Barley (Hordeum vulgare)	
Pecan (Carya illinoensis)	Corn (Zea mays)	*Pear (Pyrus communis)*
Cowpea (Vigna sinensis)	Artichoke (Cynara scolymus)	*Soybean (Glycine max)*
Onion (Allium cepa)	Tobacco (Nicotiana tabacum)	
(0.8 to 1.0 mg B/kg soil)	**(2.0 to 4.0 mg B/kg soil)**	*Blueberry (Vaccinium spp.)*
Sweet Clover (Melilotus indica)		
Garlic (Allium sativum)	Squash (Cucurbita pepo)	*Broadbean (Vivia faba)*
Sweet Potato (Ipomoea batatas)	Muskmelon (Cucumis melo)	*Chard (Beta vulgaris var. cicla)*
Wheat (Triticum aestivum)	*Peanut (Arachis hypegaea)*	*Pasture grass*
Mung Bean (Phaseolus aureux)	*Sweet Corn (Zea mays)*	*Peppermint (Mentha piperita)*
Strawberry (Fragaria spp.)	*Timothy (Phleum pratense)*	*Spearmint (Mentha spicata)*

(Table 2.2 continued)

Kindney Bean (Phaseolus vulgaris)	*Broccoli (Brassica olerasea var. italica)*	*Sudangrass (Sorghum sudanese)*
Lima Bean (Phaseolus lunatus)	*Kentucky Bluegrass (Poa pratensis)*	
*Jerusalem Artichoke (Helianthus tuberosus)***	*Sunflower (Helianthus annus)*	
Apple (Malus sylvestris)	*Rutabaga (Brassica napobrassica)*	
American Elm (Ulmus americana)	*Spinach (Spinacia oleracea)*	
Navy Bean (Phaeolus vulgaris)		
Sorgrass (Sorghum vulgare sudanese)**	Norway Maple (Acer platanoides)**	
Kiwifruit (Actinidia deliciosa)**	Tall Fexcue (Festuca arundinacea)**	
Pistachio (Pistachio vera)**	Gram (Cicer arietinum)**	
Lentil (Lens exculenta)**	American Sycamore (Platanus occidentalis)**	
	Desmodium cannum (a grass at Hawaii)**	

* Species in the shaded area are in the B database.

** These species are in the B database but are not placed in the table according to their tolerance to B toxicity.

+ After Keren and Bingham, 1985, species arranged in the order of increasing tolerance to B.

++ After Adriano, 1986, species not arranged in order of increasing tolerance to B.

Table 2.3 Soil Available B Concentration and Plant Tissue B of Different Species+

Plant Species	Soil B (mg/kg)	Leaf B (mg/kg)	Shoot B (mg/kg)	Fruit B** (mg/kg)	Number of Cases	Soil Extractant
SENSITIVE SPECIES						
Kiwifruit (Actinidia deliciosa)	0.62*	47.4*		18.1*	1	Hot Water
Pistachio (Pistachio vera)	0.74(0.08)**		47.8(21.2)		3	Saturation Extract
Beans (Phaseolus vulgaris)	0.97(0.21)	67.6(32.1)			7	Hot Water
	1.17*		93.8*		1	Hot Water
	1.78*			43.0*	1	Hot Water
Pea (Pisum sativum)	1.13(0.11)		147(44.4)		3	Hot Water
	0.96*			59.0*	1	Soil Solution
	1.48(0.7)		185(40.3)		2	Soil Solution
Soybean (Glycine max)	1.33(0.1)	564(0.0)		41.9(0.0)	2	Hot Water
Gram (Cicer arietinum)	1.25(0.69)		133(1.2)		2	Hot Water
	5.50(1.41)		386(49.5)		2	Soil Solution
Norway Maple (Acer platanoides)	1.37(0.15)	403(206)			3	Hot Water
SEMI-TOLERANT SPECIES						
Corn (Zea mays)	1.50(0.6)		33.5(3.5)		2	Hot Water
Rutabaga (Brassica napobrassica)	1.50(1.2)	105(110)			24	Hot Water
Strawberry (Fragaria spp.)	1.94*	124*			1	Hot Water
Wheat (Triticum aestivum)	2.16(0.52)		56.8(35.1)		5	Hot Water
	1.28(0.30)		104(32.7)		4	Soil Solution
	1.53*			285*	1	Soil Solution
Lentil (Lens exculenta)	2.17(1.18)		133(43.3)		2	Hot Water
Barley (Hordeum vulgare, or	2.20(0.86)		120(123)		13	Hot Water
Hordeum distichon)						
(Table 2.3 continued next page)						

(Table 2.3 continued)

Cabbage (Brassica oleracea)	2.85(3.2)	88.0(29.8)			4	Hot Water
Potato (Solanum tuberosum)	2.98(1.24)	78.0(86.3)			2	Hot Water
	2.1*			55.0*	1	Hot Water
Onion (Allium cepa)	3.86*		20.7*		1	Hot Water
Lettuce (Lactuca sativa)	3.86*		24.6*		1	Hot Water
Sunflower (Helianthus annus)	3.93(3.9)		162(38.3)		3	Hot Water
	5.58(0.8)		162(38.3)		3	Soil Solution
TOLERANT SPECIES						
Alfalfa (Medicago sativa)	3.98(3.9)		351(343)		37	Hot Water
	2.29(2.3)		468(347)		26	Saturation Extract
Oat (Avena sativa)	5.30*		175*		1	Hot Water
Pear (Pyrus communis)	4.90(4.5)			57.9(23.5)	9	Hot Water
	5.86(5.2)	51.0(17.4)			10	Hot Water
Sorgrass (Sorghum vulgare sudanese)	5.87(0.8)		307(160)		3	Hot Water
Spinach (Spinacia oleracea)	33.3(23.8)		290(169)		2	Hot Water

+ Data in the table are corresponding to the first occurrence of either visual symptoms of B toxicity or a yield reduction of 10 to 30%.

++ Fruit category includes: Fruits, Tubers, Pods of Peas and Grains.

* Numbers with an asterisk are single cases in the B database that show B toxicity.

** Numbers in brackets are standard errors.

Table 2.4 Total Boron Concentration in Norway Maple and Soil, as well as Hot Water Extractable B (HWS-B) in the Soil Collected in the Vicinity of an Appliance Manufacturing Company in Ontario on September 4, 1980.

Degree of Injury	Foliage B in	Total Soil B		Hot Water Extractable B		Soil HWS-B (0-5 cm)
of Maple Foliage	Norway Maple**	(0-5 cm)	(5-10 cm)	(0-5 cm)	(5-10 cm)	In Relation to
	(mg B/kg)	(mg B/kg)		(mg B/kg)		Foliar Injury
No Injury	170	15	15	0.6	0.6	<1.0 mgB/kg-No Injury
Trace	170	15	13	1.4	0.4	
Trace to Light	240	20	20	1.5	1.6	
Trace to Light	310	13	15	1.4	0.6	1.0-2.0 mg B/kg-Trace
Trace to Light	480	20	15	1.2	1.2	to Light Injury
Trace to Light	460	25	18	1.9	1.8	
Trace	560	23	20	1.5	0.6	
Light to Moderate	530	33	25	3.3	2.3	
Moderate to Severe	615	23	18	2.1	1.8	>2.0 mg B/kg-Light
Moderate to Severe	1060	26	33	3.9	2.6	to Severe Injury
Moderate to Severe	1280	18	18	3	2.2	

* After Palmer and Linzon, 1981.

** Unwashed maple foliage.

Table 2.5 Soil Hot Water Extractable B and Plant Tissue B Concentration of Different Species+

Plant Species	Soil B	Leaf B	Shoot B	Fruit B	Number of	Soil Extractant
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	Cases	
SENSITIVE SPECIES						
Beans (Phaseolus vulgaris)	0.35*		35.7*		1	Hot Water
	0.63(0.06)++	30.6(5.1)			3	Hot Water
Pistachio (Pistachio vera)	0.38*		16.8*		1	Saturation Extract
Gram (Cicer arietinum)	0.50*		75.0*		1	Soil Solution
SEMI-TOLERANT SPECIES						
Sunflower (Helianthus annus)	0.25(0.27)		27.5(21.2)		2	Hot Water
	0.03(0.00)		27.5(21.2)		2	Soil Solution
Rutabaga (Brassica napobrassica)	0.38(0.09)	21.5(9.8)			12	Hot Water
Cabbage (Brassica oleracea)	0.54(0.15)	34.4(14.6)			5	Hot Water
Corn (Zea mays)	0.70*		23.0*		1	Hot Water
Lettuce (Lactuca sativa)	1.17(0.44)		18.6(5.8)		2	Hot Water
Potato (Solanum tuberosum)	1.48*	11.7*			1	Hot Water
	0.70*		29.3*		1	Hot Water
TOLERANT SPECIES						
Soybean (Glycine max)	0.42(0.08)	57.3(0.0)			2	Hot Water
Sorgrass (Sorghum vulgare sudanese)	0.47(0.04)		10.2(0.07)		2	Hot Water
Alfalfa (Medicago sativa)	0.82(1.6)		72.0(124.7)		78	Hot Water
	0.68(1.3)		184(171)		25	Saturation Extract
Oat (Avena sativa)	1.30*		30.0*		1	Hot Water
Spinach (Spinacia oleracea)	1.78(0.97)		54.3(17.7)		8	Hot Water

+ Visual symptoms of B deficiency or yield reduction of 10 to 30% in the B database. ++ Number in brackets are standard error. * Single case that shows B deficiency.

Table 2.6 Toxicity of Boron to Grazing Animals*

Species	Boron Compound Tested	Type of Test	Test Response Reported	Boron Concentration	Reference
Sheep	-----	Observation in field	Young Sheep developed enteritis	Soil 30-300 mg B/kg	Koval'skii et al. (1965)
Sheep	Boric Acid H3BO3	Daily feed	Sheep developed enteritis	40 mg B/kg	Koval'skii et al. (1965)
Cattle	Boric Acid H3BO3	Cattle exposed to high concentrations of B in their drinking water	Swelling and irritation of legs, lethargy, diarrhoea with 30-day exposure	150-300 mg B/liter	Green and Weeth (1977)
Cattle	Boric Acid H3BO3	Cattle exposed to high concentration of B in their drinking water	No overt signs of toxicosis with 10-day exposure	120 mg B/liter	Weeth et al. (1981)

* after Butterwick et al., 1989.

2.3 Chromium (Cr)

- Cr is essential to mammals (Bowen, 1979), and low concentrations appear to be beneficial (though not necessarily essential) to plants (NAS, 1974)

- hexavalent chromium (Cr VI) is particularly toxic to plants and animals (Bowen, 1979)

- the Phytotoxicology Section "upper limit of normal" Cr guideline for urban Ontario surface soils is 50 ppm (MOE, 1989a)

- the predominant form of Cr in soils is trivalent (Cr III) (Kabata-Pendias and Pendias, 1984)

- plant tissue levels of trivalent Cr considered phytotoxic are: 10 ppm (Davis et al., 1978); 20 ppm (Chaney, 1982)

- a Cr III level of 3000 ppm has been established as the maximum dietary concentration chronically tolerated by chickens (NAS, 1980), whereas Davis et al. (1978) report a critical total diet Cr level for livestock of 50 ppm

- the bulk of Cr absorbed by plants concentrates in roots and is poorly translocated to the tops (NRCC, 1976), although translocation of Cr VI appears to be greater than Cr III (Lahouti and Peterson, 1979)

- plants generally will die from phytotoxic effects before they can accumulate amounts of Cr that would be toxic to consumer organisms (NRCC, 1984)

- Monenco (1984a) recommended a soil criterion for trivalent chromium of 1000 ppm, based upon a literature review which revealed maximum Cr levels of 2.2 ppm and 513 ppm in plants and soil, respectively, and upon the similarity between availability of Cr and Pb in soils

- Monenco (1984b) on the basis of a literature review, concluded that Cr VI can exist in soils and is highly toxic to plants

- the solubility (availability) of Cr VI increases in both acidic and alkaline conditions, but is minimal at pH 5.5 - 8 (Kabata- Pendias and Pendias, 1984)

- soluble Cr VI is normally reduced to insoluble Cr III in soils except in the presence of high oxidized Mn levels (NRCC, 1984; Kabata-Pendias and Pendias, 1984)

- a level of 10 ppm Cr VI in soils has been shown to be phytotoxic to soybeans (Turner and Rust, 1971)
- a soil clean-up level for total Cr of 1000 ppm has been proposed in Great Britain (Smith, 1981)
- Anderson et al. (1983) recommend a maximum soil Cr level of 1000 ppm at closure of hazardous waste land treatment sites
- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Cr of 250 to 800 ppm
- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Cr level in sludged agricultural soils of 120 ppm.

Recommendation: **Total soil Cr concentrations should be <1000 ppm, and hexavalent chromium (CrVI)concentrations should be <10 ppm, for all land use categories.**

2.4 Cobalt (Co)

- Co is essential for animals, man and at least some plants (Bowen, 1979)
- Co is relatively non-toxic to animals and man, and there are no reports of Co toxicity attributable to consumption of natural feedstuffs (Peterson and Girling, 1981)
- although plant species vary widely in Co content, phytotoxicity due to Co is rarely observed in nature (Kabata-Pendias and Pendias, 1984); however, an addition of only 25 ppm Co to soil was reportedly toxic to rice plants (Kabata-Pendias and Pendias, 1984)
- 6 ppm Co in tissue reduced growth of barley (Davis et al., 1978)
- Co deficiency in plants, leading to health effects in grazing animals, is generally of greater concern than an excess of Co (Peterson and Girling, 1981
- the Phytotoxicology Section "upper limit of normal" Co guideline for both urban and rural Ontario surface soils is 25 ppm (MOE, 1989a)
- Bowen (1979) gives a mean Co level in world soils of 8 ppm, and a range of 0.05-65 ppm

- Anderson et al. (1983) recommend a maximum soil Co level of 200 ppm on closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Co of from 50 to 300 ppm

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Co level in sludged agricultural soils of 20 ppm

Recommendation: **Soil Co concentrations should be <50 ppm for agricultural and residential/parkland land use categories and <100 ppm for industrial/commercial land use.**

2.5 Copper (Cu)

- Cu is an essential element for all organisms (Bowen, 1979)

- the Phytotoxicology Section "upper limit of normal" copper guideline for urban Ontario surface soils in 100 ppm (MOE, 1989a)

- Monenco (1984a) recommended a clean-up level of 330 ppm Cu, based on a regression analysis of Cu levels in plants vs. in soil (330 ppm in soil resulted in the conservative phytotoxic Cu level in vegetation of 25 ppm (Chaney, 1982))

- Davis et al. (1978) have reported a slightly smaller critical Cu level (10% growth reduction) of 20 ppm in barley

- Health and Welfare Canada has established a "maximum residue limit" for fresh fruits and vegetables of 50 ppm Cu (equivalent to 250 - 1000 ppm, dry weight)

- maximum tolerable dietary Cu concentrations for livestock range from 10 ppm (sheep) to 800 ppm (NAS, 1980)

- 300 ppm Cu in soil has been reported to be toxic to citrus (Murphy & Walsh, 1982)

- Anderson et al. (1983) recommend a maximum soil Cu level of 250 ppm at closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Cu of from 100 to 500 ppm

- faculty of the University of Guelph Veterinary Science Department have recommended that sheep pasture soils not contain more than 200 ppm Cu (personal communication via the Sludge and Waste Utilization Committee)

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Cu level in sludged agricultural soils of 100 ppm.

Recommendation: **Soil Cu concentrations should be <200 ppm for agricultural land use (as well as residential/parkland land use where there is a potential for animal grazing). Otherwise, soil Cu concentrations should be <300 ppm for residential/parkland and industrial/commercial land uses.**

2.6 Molybdenum (Mo)

- Mo is a essential element for all organisms (Bowen, 1979)

- the Phytotoxicology Section "upper limit of normal" molybdenum guideline for urban Ontario surface soils is 3 ppm (MOE, 1989a)

- Monenco (1984b) recommended a soil criterion for Mo of 40 ppm, based on potential phytotoxicity

- 135 ppm Mo in plant tissue was reported to be toxic to barley (Davis et al., 1978)

- there is generally a poor relationship between total Mo content in soils and in vegetation (Monenco, 1984b)

- molybdenum-induced copper deficiency (molybdenosis) may occur in animals consuming vegetation with elevated (10 - 20 ppm) Mo concentrations (Tolle and Arthur, 1983; Chappell and Petersen, 1977)

- soils containing 5 ppm Mo or more may support herbage containing elevated Mo levels, resulting in molybdenosis (Thornton, 1981)

- the maximum dietary Mo concentration chronically tolerated by domestic livestock ranges from 5 to 100 ppm (NAS, 1980)

- Anderson et al. (1983) recommend a maximum soil Mo level of 5 ppm at closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Mo of from 40 to 200 ppm

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Mo level in sludged agricultural soils of 4 ppm

Recommendation: **Soil Mo concentrations should be <5 ppm for agricultural, residential/parkland land use categories (where there is a possibility that vegetation may be consumed by livestock), and <40 ppm for industrial/commercial land use.**

2.7 Nickel (Ni)

- Ni is essential to some plants and all vertebrates (Bowen, 1979)

- the Phytotoxicology Section "upper limit of normal" Ni guideline for urban Ontario surface soils is 60 ppm (MOE, 1989a)

- Monenco (1984a) recommended a soil criterion for Ni of 200 ppm, which was twice the U.S. suggested maximum Ni loading of 100 ppm for a fine-textured soil

- 50 ppm Ni is the maximum dietary concentration chronically tolerated by livestock (Davis et al., 1978; NAS, 1980)

- Davis et al. (1978) cite toxic levels of Ni in plant tissue ranging from 11 to 147 ppm

- 266 ppm Ni in soil (88 ppm in oat plants) resulted in moderate chlorosis and stunting in oats (Anderson et al., 1973)

- Monenco (1984a) reported a maximum plant tissue Ni level of 3.2 ppm at a soil Ni level of 60 ppm; assuming a linear relationship, a plant tissue level of 11 ppm Ni (minimum phytotoxic level) could result from a soil concentration of 206 ppm Ni

- Anderson et al. (1983) recommend a maximum soil Ni level of 100 ppm at closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Ni of from 100 to 500 ppm

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Ni level in sludged agricultural soils of 32 ppm

Recommendation: **Soil Ni concentrations should be <200 ppm for all land use categories.**

2.8 Selenium (Se)

- Se is essential to some plants and all vertebrates (Bowen, 1979)
- the Phytotoxicology Section "upper limit of normal" Se guideline for urban Ontario surface soils is 2 ppm (MOE, 1989a)
- no instances of Se phytotoxicity have been reported in the field (Kabata-Pendias and Pendias, 1984)
- Davis et al. (1978) report that 30 ppm Se in plant tissue was toxic to barley, while Chaney (1982) reports a phytotoxic tissue Se level of 100 ppm
- Marier and Jaworski (1983) state that Se injury to crop plants can occur at tissue concentrations of > 300 ppm
- rye grass growth was reduced at a Se application rate of 10 kg/ha (equivalent to approximately 5 ppm in surface soil) (Anderson et al., 1983)
- selenium is toxic to livestock, and the difference between essential and toxic levels in animals feed is quite small (Kabata-Pendias and Pendias, 1984)
- Davis et al. (1978) cite 5 ppm Se as the critical total diet level for livestock, whereas NAS (1980) has established 2 ppm Se as the maximum dietary level chronically tolerated by swine and chickens
- although total soil Se has been reported to give a better measure of plant response than do its soluble fractions (Kabata-Pendias and Pendias, 1984), most studies covering a wide range of soil types illustrate the lack of a correlation between total soil and plant Se content (Peterson et al., 1981)
- soils containing more than 0.5 ppm of total selenium can produce herbage containing 4 - 5 ppm Se or more, and are therefore, regarded as potentially dangerous to livestock (Underwood, 1971)

- Anderson et al. (1983) recommend a maximum soil Se level of 5 ppm at closure of hazardous waste land treatment sites

- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Se level in sludged agricultural soils of 1.6 ppm

Recommendation: **Soil Se concentrations should be <2 ppm for agricultural, residential/parkland land use categories (where there is a possibility that vegetation may be consumed by livestock), and <10 ppm for industrial/commercial land use.**

2.9 Silver (Ag)

- Ag is very toxic to plants but is much less toxic to mammals (Bowen, 1979)

- the Phytotoxicology Section has not developed an "upper limit of normal" guideline for Ag in Ontario soils

- mean levels of Ag in soil are reported as 0.05 ppm (Bowen, 1979) and 1 ppm (Brooks, 1972), with ranges of 0.01 - 5 ppm (Peterson and Girling, 1981) and 0.01 - 8 ppm (Bowen, 1979)

- although soluble silver compounds are highly toxic, Ag apparently is essentially immobile (unavailable) in soils at pH > 4 (Kabata- Pendias and Pendias, 1984)

- however, there is a relationship between Ag in many plant species and in soil (Kabata-Pendias and Pendias, 1984)

- Monenco (1984b) recommended a soil criterion of 100 ppm Ag based on potential phytotoxicity

- plant tissue Ag levels of 5 ppm in bush beans (cited in Kabata- Pendias and Pendias, 1984) and 4 ppm in barley (Davis et al., 1978) resulted in reduced yields

- based on a logarithmic regression calculated from information provided by Monenco (1984b), 4 ppm Ag in plant tissue is predicted at 50 ppm Ag in soil (AgI studies excluded because AgI has extremely low water solubility)

- 28 pm Ag (added to soil as AgI [in organic solvent]) reduced emergence of lodgepole pine (cited in Monenco, 1984b)

- Anderson et al. (1983) suggest a maximum soil Ag level of 90 ppm at closure of hazardous waste land treatment sites

Recommendation: **Soil Ag concentrations should be <25 ppm for agricultural and residential/parkland land use categories and <50 ppm for industrial/commercial land use.**

2.10 Zinc (Zn)

- Zn is an essential element for all organisms (Bowen, 1979)
- the Phytotoxicology Section "upper limit of normal" zinc guideline for urban Ontario surface soils is 500 ppm (MOE, 1989a)
- Monenco (1984a) recommended a soil criterion for Zn of 1000 ppm, based on a literature review which revealed a plant Zn level of 130 ppm at a soil Zn level of 1000 ppm
- Davis et al. (1978) cite phytotoxic tissue Zn levels of from 200 to 400 ppm
- Collins (1981) cites studies reporting that 60 and 81 ppm Zn in wheat and corn tissue, respectively, were phytotoxic
- based on a regression analysis of Zn levels in plants vs. in soil (Monenco, 1984a), the predicted soil Zn concentration corresponding to a plant Zn level of 60 ppm is 410 ppm
- the tolerance of domestic livestock to Zn in animal feed ranges from 300-1000 ppm (NAS, 1980)
- Anderson et al. (1983) recommend a maximum soil Zn level of 500 ppm at closure of hazardous waste land treatment sites
- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Zn of from 500 to 3000 ppm
- the Ontario government (OMAF, MOE, MOH, 1986) has established a maximum allowable Zn level in sludged agricultural soils of 220 ppm

Recommendation: **Soil Zn concentrations should be <800 ppm for all land use categories.**

2.11 Sodium Adsorption Ratio (SAR)

- SAR = $Na^+/[(Ca^{+2} + Mg^{+2})/2]^{1/2}$, where concentrations are in soil solution in meq/1.

- Monenco Consultants (1984a) recommended a soil clean-up criterion for SAR of 15, based upon adverse effects on permeability and structural stability of soil

- at SAR values >5, water penetration can be reduced and soil structure may deteriorate (Fuller and Warrick, 1985).

- a guideline established by the University of Guelph states that wastes with an SAR >5 should not be added to the soil (Bates, 1986)

- SAR values > 12 are indicative of sodic soils, and growth of non-tolerant plant species may be restricted (Richards, 1954; Brown et al., 1985).

- nutritional effects due to inability of non-tolerant plants to absorb adequate amounts of Ca and Mg may occur at SAR's > 10, although most crops are affected nutritionally at SAR's of about 25 (Bernstein, 1975)

Recommendation: **SAR of soil solution should be <5 ppm for agricultural and residential/parkland land use categories and <12 ppm for industrial/commercial land use.**

3 RATIONALES FOR PROVISIONAL ECOTOXICITY-BASED SOIL CRITERIA.

3.1 Antimony (Sb)

- Sb is not essential for animals or plants (Kabata-Pendias and Pendias, 1984)

- although soluble forms of Sb are readily taken up by plants, there are no reports of Sb phytotoxicity in the field (Kabata-Pendias and Pendias, 1984)

- the Phytotoxicology Section "upper limit of normal" Sb level in urban Ontario surface soils in 8 ppm (MOE, 1989a)

- Bowen (1979) gives a mean Sb concentration for world soils of 1 ppm and a range of 0.2 - 10 ppm

- Anderson et al. (1983) suggest a maximum soil Sb level of 225 ppm on closure of hazardous waste land treatment sites

Recommendation: **Soil Sb concentrations should be <25 ppm for agricultural and residential/parkland land use categories and <50 ppm for industrial/commercial land use.**

3.2 Barium (Ba)

- Ba may be essential to mammals (Bowen, 1979), but apparently is not essential to plants (Kabata-Pendias and Pendias, 1984)

- some forms of Ba may be toxic to man (personal communication, J. Stopps, Min. of Labour)

- Ba is mobile in acid soils and is readily taken up by plants (Kabata-Pendias and Pendias, 1984)

- concentrations of 1% (10,000 ppm) Ba in plants may be highly phytotoxic (Kabata-Pendias and Pendias, 1984)

- 500 ppm Ba in tissue reduced growth of barley (Davis et al., 1978)

- the Phytotoxicology Section has not established an "upper limit of normal" guideline for Ba in Ontario soils

- Bowen (1979) gives a mean level for Ba in world soils of 500 ppm, with a range of 100 - 3000 ppm

- in view of the relatively high concentrations of Ba in plants and soils, and the lack of information about its physiological effects, more research on this relatively inert element is required (Peterson and Girling, 1981)

- Anderson et al. (1983) suggest a maximum soil Ba level of 450 ppm on closure of hazardous waste land treatment sites

- the Dutch government (Moen et al., 1985) has adopted soil clean-up criteria for Ba of from 400 to 2000 ppm

Recommendation: **Soil Ba concentrations should be <1000 ppm for agricultural and residential/parkland land use categories and <2000 ppm for industrial/commercial land use.**

3.3 Beryllium (Be)

- Be is not known to be essential to mammals (Bowen, 1979), and apparently is not essential to plants (Kabata-Pendias and Pendias, 1984)
- Be is potentially phytotoxic, particularly in acid soils (Peterson and Girling, 1981)
- toxic concentrations of Be in plants generally range from 10 to 50 ppm, while 2 to 16 ppm Be in solution may be highly phytotoxic (Kabata-Pendias and Pendias, 1984)
- only 0.6 ppm Be in tissue reduced growth of barley (Davis et al., 1978)
- there is no evidence that existing levels of Be in food plants pose a health risk to man, but more data are needed (Kabata-Pendias and Pendias, 1984)
- the Phytotoxicology Section has not established an "upper limit of normal" guideline for Be in Ontario soils
- Bowen (1979) gives a mean level for Be in world soils of 0.3 ppm, with a range of 0.01 - 40 ppm
- Anderson et al. (1983) recommend a maximum soil Be level of 50 ppm at closure of hazardous waste sites

Recommendation: **Soil Be concentrations should be <5 ppm for agricultural and residential/parkland land use categories amd <10 ppm for industrial/commercial land use.**

3.4 Vanadium (V)

- V is essential to animals, man and at least some plants (Bowen, 1979)
- concentrations of soluble (available) V ranging from 10 to 140 ppm are reportedly phytotoxic under experimental conditions (Peterson and Girling, 1981)

- however, there are no reports of V phytotoxicity in the field (Kabata-Pendias and Pendias, 1984)

- V added at a rate of 50 - 100 ppm to conifer forest soils reduced acid phosphatase activity (Peterson and Girling, 1981)

- pronounced differences in V content among plants have been reported, which may reflect both analytical difficulties and pollution (Kabata-Pendias and Pendias, 1984)

- 2 ppm V in tissue reduced growth of barley (Davis et al., 1978)

- the Phytotoxicology Section "upper limit of normal" guideline for V in urban Ontario surface soils is 70 ppm (MOE, 1989a)

- Bowen (1979) gives a mean level for V in world soils of 90 ppm, with a range of 3 - 500 ppm

- further studies into the environmental behaviour of V are warranted (Peterson and Girling, 1981)

- Anderson et al. (1983) recommend a maximum soil V level of 500 ppm on closure of hazardous waste land treatment sites

Recommendation: **Soil V concentrations should be <250 ppm for land use categories.**

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5 ECOTOXICITY-BASED SOIL CRITERIA TABLES

Table 5.1 Ecotoxicity-Based Soil Criteria

Parameter[c]	Criteria for Proposed Land Use[a][b]			
	Residential/Parkland/ Agricultural[d]		Industrial/Commercial	
	Medium & Fine Textured Soils	Coarse Textured Soils[d]	Medium & Fine Textured Soils	Coarse Textured Soils[e]
Arsenic	25	20	50	40
Boron[f]	1.5	1.5	2.0	2.0
Chromium (VI)	10	8	10	8
Chromium (total)	1000	750	1000	750
Cobalt	50	40	100	80
Copper	200[g]	150[g]	300	225
Molybdenum	5[g]	5[g]	40	40
Nickel	200	150	200	150
Selenium	2[g]	2[g]	10	10
Silver	25	20	50	40
Zinc	800	600	800	600
SAR[h]	5	5	12	12

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a. Soil clean-up criteria recommended by the Phytotoxicology Section, Standards Development Branch, Ministry of the Environment. The criteria are based primarily on phytotoxicity, except for (g) based on health of grazing animals.

b. For comparison with these guidelines, analyses for metals and metalloids must be conducted using an approved strong, mixed-acid digestion procedure. Refer to the 1995 MOEE document entitled "Guidance on Sampling and Analytica Methods for Use at Contaminated Sites in Ontario", if in doubt about acceptable methods.

c. All units are in ppm (ug/g), dry weight, unless otherwise stated.

d. Guidelines have been endorsed by the OMAF/MOE/MOH Sludge and Waste Utilization Committee.

e. Defined as greater than 70% sand and less than 17% organic matter.

f. Boron criteria are based on a hot water extract.

g. Criteria based on health of grazing animals.

h. SAR = sodium adsorption ratio

Table 5.2 Provisional Ecotoxicity-Based Soil Criteria.

Parameter[b]	Criteria for Proposed Land Use[a,c,d]: Residential/Parkland/ Agricultural[e]: Medium & Fine Textured Soils	Residential/Parkland/ Agricultural[e]: Coarse Textured Soils[f]	Industrial/Commercial: Medium & Fine Textured Soils	Industrial/Commercial: Coarse Textured Soils[f]
Antimony	25	20	50	40
Barium	1000	750	2000	1500
Beryllium	5	4	10	8
Vanadium	250	200	250	200

a. These guidelines are tentative; actual permissible levels contaminants may vary according to site-specific circumstances. Further information on the application of these guidelines may be obtained from the Phytotoxicology Section of the Air Resources Branch, Ministry of the Environment.

b. All units are in ppm (ug/g), dry weight.

c. For comparison with these guidelines, analyses must be conducted using an approved strong, mixed-acid digestion procedure. Contact the Laboratory Services Branch of MOE if in doubt about acceptable methods.

d. These provisional guidelines apply to soil of minimum pH 6.

e. Guidelines have been endorsed by the OMAF/MOE/MOH Sludge and Waste Utilization Committee.

f. Defined as greater than 70% sand and less than 17% organic matter.

Appendix B.4: U.S. EPA Ambient Water Quality Criteria (AWQC) for Fresh Water and Lowest Observable Effects Levels (LOEL) for Fresh Water Organisms from the Aquatic Information and Retrieval System (AQUIRE) Database.

Appendix B.4: USEPA Ambient Water Quality Criteria (AWQC)for Fresh Water and Lowest Observable Effects Levels (LOEL), for Fresh Water, from the Aquatic Information and Retrieval System (AQUIRE) database.

CHEMICAL PARAMETER	USEPA AFWQC (ug/L)	AFWQC Effects Basis	AQUIRE FWLOEL (ug/L)	FWLOEL Effects Basis
ACENAPHTHENE	520	FCC	-	-
ACENAPHTHYLENE	ND	-	ND	-
ACETONE	-	-	330	Chlorella pyrenoidosa 3.2d-reduced growth Parasher et.al. 1978
ALDRIN	3	FAC	-	-
ANTHRACENE	-	-	1.2	Daphnia pulex 24h-mortality Allred et.al. 1985
ANTIMONY	1600	FCC	-	-
ARSENIC	48	FCC	-	-
BARIUM	-	-	2300	Chlorella vulgaris 91.3d-reduced growth De Jong, 1985
BENZENE	5300	FAC	-	-
BENZO(a)ANTHRACENE	-	-	1.8	fathead minnow 65.1d-LT50(UV induced) Oris and Giesy, 1987
BENZO(a)PYRENE	-	-	0.21	rainbow trout eggs failure to hatch Hannah et.al. 1982
BENZO(b)FLUORANTHENE	ND	-	ND	-
BENZO(g,h,i)PERYLENE	-	-	0.2	Daphnia magna 828min-LT50(UVinduced) Newstead & Giesy, 1987
BENZO(k)FLUORANTHENE	-	-	7.4	Daphnia magna 780min-LT50(UVinduced) Newstead & Giesy, 1987
BERYLLIUM	5.3	FCC	-	-
BIPHENYL, 1,1-	-	-	170	Daphnia magna 21d-reduced growth Gersich et.al. 1989
BIS(2-CHLOROETHYL)ETHER	238,000	FAC*	-	-
BIS(2-CHLOROISOPROPYL)ETHER	238,000	FAC*	-	-
BIS(2-ETHYLHEXYL)PHTHALATE	3	FCC*	-	-

CHEMICAL PARAMETER	USEPA AFWQC (ug/L)	AFWQC Effects Basis	AQUIRE FWLOEL (ug/L)	FWLOEL Effects Basis
BORON	-	-	113,000	coho salmon 283d-LC50 Thompson et.al. 1976
BROMODICHLOROMETHANE	-	-	67,000	carp 5d-LC50 Mattice et.al. 1981
BROMOFORM	-	-	29,000	bluegill 96h-LC50 Buccafusco et.al. 1981
BROMOMETHANE	-	-	320	guppies 90d-growth impairment Weston et.al. 1988
CADMIUM	1.1	FCC	-	-
CARBON TETRACHLORIDE	35,200	FAC	-	-
CHLORDANE	0.004	FCC	-	-
CHLOROANILINE, p-	-	-	10	*Daphnia magna* 21d-reduced growth Kuhn et.al. 1989
CHLOROBENZENE	50	FCC*	-	-
CHLOROFORM	1240	FCC	-	-
CHLOROPHENOL, 2-	4380	FAC	-	-
CHROMIUM (TOTAL)	-	-	200	chinook salmon 12wk-reduced growth Oson, 1958
CHROMIUM (VI)	11	FCC	-	-
CHRYSENE	-	-	0.7	*Daphnia magna* 24h-LC50(UV induced) Newstead & Giesy, 1987
COBALT	-	-	10	*Daphnia magna* 48h-LC50 Biesinger et.al. 1972
COPPER	-	-	2.3	rainbow trout 168h-LC50 Cusimano et.al. 1986
CYANIDE	5.2	FCC	-	-
DIBENZO(a,h)ANTHRACENE	-	-	15	*Daphnia magna* 185min-LT50(UVinduced) Newstead & Giesy, 1987
DIBROMOCHLOROMETHANE	-	-	65,000	*Tetrahymena pyriformis* 24h-EC50 reduce growth Yoshioka et.al. 1985
DICHLOROBENZENE, 1,2- (o-DCB)	763	FCC*	-	-

CHEMICAL PARAMETER	USEPA AFWQC (ug/L)	AFWQC Effects Basis	AQUIRE FWLOEL (ug/L)	FWLOEL Effects Basis
DICHLOROBENZENE, 1,3- (m-DCB)	763	FCC*	-	-
DICHLOROBENZENE, 1,4- (p-DCB)	763	FCC*	-	-
DICHLOROBENZIDINE, 3,3'-			500	bluegill 5d-LC50 Sikka et.al. 1978
DDD	0.6	FAC	-	-
DDE	1050	FAC	-	-
DDT	0.001	FCC	-	-
DICHLOROETHANE, 1,1-	-	-	20000	guppies 7d-LD50 Konemann, 1981
DICHLOROETHANE, 1,2-	20000	FCC	-	-
DICHLOROETHYLENE, 1,1-	11600	FAC*	-	-
DICHLOROETHYLENE, CIS-1,2-	11600	FAC*	-	-
DICHLOROETHYLENE, TRANS-1,2-	11600	FAC*	-	-
DICHLOROPHENOL, 2,4-	365	FCC	-	-
DICHLOROPROPANE, 1,2-	5700	FAC	-	-
DICHLOROPROPENE, 1,3-	244	FCC*	-	-
DIELDRIN	0.0019	FCC	-	-
DIETHYL PHTHALATE	3	FCC*	-	-
DIMETHYL PHTHALATE	3	FCC*	-	-
DIMETHYLPHENOL, 2,4-	2120	FAC	-	-
DINITROPHENOL, 2,4-	150	FCC*	-	-
DINITROTOLUENE, 2,4-	230	FCC	-	-
DIOXIN/FURAN (ng TEQ/g soil)	0.00001	FCC	-	-
ENDOSULFAN	0.056	FCC	-	-
ENDRIN	0.0023	FCC	-	-
ETHYLBENZENE	32000	FAC	-	-
ETHYLENE DIBROMIDE	-	-	2800	AQUIRE

CHEMICAL PARAMETER	**USEPA AFWQC (ug/L)**	**AFWQC Effects Basis**	**AQUIRE FWLOEL (ug/L)**	**FWLOEL Effects Basis**
FLUORANTHENE	3980	FAC	-	-
FLUORENE	-	-	29	*Chironomus reparius* 30d-LOEC emergence Finger et.al. 1985
HEPTACHLOR	0.0038	FCC	-	-
HEPTACHLOR EPOXIDE	ND	-	ND	-
HEXACHLOROBENZENE	3.68	FCC	-	-
HEXACHLOROBUTADIENE	9.3	FCC	-	-
HEXACHLOROCYCLOHEXANE, GAMMA	0.08	FCC	-	-
HEXACHLOROETHANE	540	FCC	-	-
INDENO(1,2,3-cd)PYRENE	ND	-	ND	-
LEAD	3.2	FCC	-	-
MERCURY	0.012	FCC	-	-
METHOXYCHLOR	0.03	FCC	-	-
METHYL ETHYL KETONE	-	-	120,000	*Anacystis aeruginosa* 8d-reduced growth Bringmann & Kuhn,1978b
METHYL ISOBUTYL KETONE	-	-	42,800	fathead minnow 96h-LC50 Geiger et.al. 1986
METHYL MERCURY	0.012	FCC	-	-
METHYL TERT BUTYL ETHER	-	-	100,000	frog tadpoles 43d-weight loss Paulov, 1987
METHYLENE CHLORIDE	-	-	13200	rainbow trout LC50 Black et.al. 1982
METHYLNAPHTHALENE, 2-	-	-	1500	*Eurystemora affinis* 48h-LC50 Abernethy et.al. 1986
MOLYBDENUM	-	-	730	rainbow trout eggs 28d-LC50, Birge, 1980
NAPHTHALENE	620	FCC	-	-
NICKEL	-	-	160	AQUIRE (at hardness 100mg/L)
PENTACHLOROPHENOL	-	-	13	AQUIRE (at pH 7.8)

CHEMICAL PARAMETER	USEPA AFWQC (ug/L)	AFWQC Effects Basis	AQUIRE FWLOEL (ug/L)	FWLOEL Effects Basis
PHENANTHRENE	6.3	FCC	-	-
PHENOL	2560	FCC	-	-
POLYCHLORINATED BIPHENYLS	0.014	FCC	-	-
PYRENE	-	-	4	*Daphnia magna* 1h-LC50(photo induced) Kagan et.al. 1985
SELENIUM	5	FCC	-	-
SILVER	0.12	FCC	-	-
STYRENE	ND	-	ND	-
TETRACHLOROETHANE, 1,1,1,2-	9320	FAC	-	-
TETRACHLOROETHANE, 1,1,2,2-	2400	FCC	-	-
TETRACHLOROETHYLENE	840	FCC	-	-
THALLIUM	40	FCC	-	-
TOLUENE	17500	FAC	-	-
TOTAL PETROLEUM HYDROCARBONS (gas/diesel)	ND	-	ND	-
TOTAL PETROLEUM HYDROCARBONS (heavy oils)	ND	-	ND	-
TRICHLOROBENZENE, 1,2,4-	50	FCC*	-	-
TRICHLOROETHANE, 1,1,1-	18000	FAC	-	-
TRICHLOROETHANE, 1,1,2-	9400	FCC	-	-
TRICHLOROETHYLENE	21900	FCC	-	-
TRICHLOROPHENOL, 2,4,5-	63	FCC	-	-
TRICHLOROPHENOL 2,4,6-	970	FCC	-	-
VANADIUM	-	-	20	*Chlorella pyrenoidosa* 3d-cell division Meisch&Benzschawell 1978
VINYL CHLORIDE	-	-	356,000	golden orfe 48h-LC50 Juhnke&Ludemann, 1978
XYLENES	ND	-	ND	-

CHEMICAL PARAMETER	**USEPA AFWQC (ug/L)**	**AFWQC Effects Basis**	**AQUIRE FWLOEL (ug/L)**	**FWLOEL Effects Basis**
ZINC	-	-	110	AQUIRE (at hardness 100 mg/L)
ELECTRICAL CONDUCTIVITY (mS/cm)	ND	-	ND	-
CHLORIDE	ND	-	ND	-
NITRATE	ND	-	ND	-
NITRITE	-	-	200	rainbow trout 96h-LC50 Lewis & Morris, 1986
SODIUM ADSORPTION RATIO (SAR)	ND	-	ND	-
SODIUM	ND	-	ND	-

Note: AQUIRE = Aquatic information and retreival system
FAC = Final Acute Criterion in USEPA Gold Book.
FCC = Final Chronic Criterion in USEPA Gold Book.
FAC/FCC values are estimates of the concentration of contaminant corresponding to the cumulative probability of 0.05 in acute or chronic toxicity values for the genera with which acceptable acute or chronic tests have been conducted with a given contaminant.
ND = no data
* means a USEPA AFWQC criterion for a group of chemicals used.

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Appendix B.5: Relevant Portions of Massachusetts Background Documentation for the Development of the MCP Numerical Standards

This appendix provides relevant sections and appendices from the 1994 Massachusetts, Department of Environment Protection publication entitled "Background Documentation for the Development of the MCP Numerical Standards". The following portions of the Massachusetts document are included:

Section 2.0	Dose Response Information
Table 2.1	Toxicity Information
Table 3.1	PQLs, Background, Solubility, Odour Data and Other Physical Constants
Section 6.0	References
Appendix A	Derivation of Soil S-1 Ingestion and Dermal Contact Rates
Appendix B	Derivation of Soil S-2 Ingestion and Dermal Contact Rates
Appendix C	Derivation of Soil S-3 Ingestion and Dermal Contact Rates
Appendix F	Development of Dilution/Attenuation Factors (DAFs) for the Leaching-Based Soil Standards
Appendix G	Selection of Practical Quantification Limits for Method I Chemicals

BACKGROUND DOCUMENTATION FOR THE DEVELOPMENT OF THE MCP NUMERICAL STANDARDS

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup
and
Office of Research and Standards

April 1994

2.0 DOSE-RESPONSE INFORMATION

This section contains the dose-response information and physical constants for each of the oil or hazardous material for which MCP Method 1 Standards are derived. This information is coupled with the exposure information described in Sections 4 and 5 to develop the standards for each Groundwater and Soil Category.

The dose-response information is divided into three major categories:

- Toxicity information associated with threshold (non-carcinogenic) health effects.
- Toxicity information concerning carcinogenicity, either from human epidemiologic data or from laboratory studies.
- The _R_elative *_A_bsorption* _F_actors (RAFs) used to relate the toxicity values from the literature to the exposure pathways of concern in this spreadsheet.

The classification of a chemical as a carcinogen does not preclude an evaluation of that same chemical for potential non-carcinogenic health risks.

2.1 THRESHOLD EFFECTS

For non-carcinogenic health effects it is believed that a dose level exists at and below which no adverse health effects would be expected. Such a level is referred to as a ***threshold dose***. While it is impossible to specify a theoretical threshold dose for a given chemical, it is possible to estimate a human sub-threshold dose at which no adverse health effects would be expected. Such a value is typically derived from the No Observable Adverse Effects Level (NOAEL) of an animal study (although human data are used, when available) by application of uncertainty factors (UF) to account for interspecies variation, exposure duration and to protect sensitive populations. Important factors to consider when identifying and using such a sub-threshold dose include:

- the route of administration of the dose (inhalation, oral, dermal contact, etc...)
- the duration of exposure to that dose (lifetime, chronic, subchronic, or acute exposure)
- the absorption efficiency (if any) used to calculate that dose
- the age of the person receiving the dose.

Several types of "sub-threshold dose" values were used to develop the MCP Method 1 Standards. The sources of these values are described in general below, and Table 2.1 provides the specific values. The source for a specific toxicity value may be found using the references adjacent to each value in the table, and the list of references at the end of the table.

For oral and dermal exposures, the U.S. EPA-derived oral Reference Dose (RfD) was used when one was available for the chemical of concern. Chronic RfDs are available from the U.S. EPA's on-line database, the *Integrated Risk Information System* (IRIS). Subchronic RfDs from the U.S. EPA's *Health Effects Assessment Summary Tables* (HEAST) were used for the development of Soil Category S-3 Standards. HEAST also served as a source of US EPA derived chronic RfDs.

For inhalation exposures, the U.S. EPA-derived inhalation Reference Concentration (RfC) was used when one was available for the chemical of concern. Chronic RfCs are available from the U.S. EPA's on-line database, the *Integrated Risk Information System* (IRIS) and the U.S. EPA's *Health Effects Assessment Summary Tables* (HEAST). In the absence of an RfC, the "*Allowable Threshold Concentration*" (MA DEQE, 1989a) was used. The Allowable Threshold Concentration (ATC) is a value derived from the Threshold Effects Exposure Limit (TEL) described in CHEM (MA DEP, 1990c). (The TEL value represents 20% of an allowable concentration, or ATC. Thus the ATC is equal to five times the TEL. The TEL was derived in a manner considering children to be the most sensitive potential receptors.) The inhalation pathway was evaluated only for volatile chemicals in the development of GW-2 standards.

For a limited number of chemicals, an analogous toxicity value was identified or developed by MA DEP Office of Research and Standards staff when a subchronic or chronic RfD or RfC was not available from IRIS or HEAST. The documentation for these values is published elsewhere (MA DEP, 1992a).

2.2 CARCINOGENIC EFFECTS

Unlike the non-carcinogenic health effects, it is generally assumed that there is no threshold dose for carcinogenicity, that there is no dose of a carcinogenic substance (other than no exposure) which is associated with zero risk. The ability of a chemical to increase the incidence of cancer in a target population is described by one of two measures: the ***cancer slope factor*** or the ***unit risk***. The cancer slope factor was used to develop the MCP Method 1 Standards.

The cancer slope factor for a chemical is derived by the EPA's Cancer Assessment Group (CAG). Using data derived from animal studies, the slope factor is an estimate of the upper 95% Confidence Limit of the slope of the dose-response curve extrapolated to low doses. For some chemicals, human epidemiologic data is the basis of an estimate of the carcinogenic potency, although the most common basis of these values is an animal study. The slope factor is given in units of $(mg/kg/day)^{-1}$. It is based upon the concept of a lifetime average daily dose.

The inhalation Unit Risk is the upper 95% Confidence Limit of the mean incremental lifetime cancer risk estimated to result from lifetime exposure to an agent if it is in the air at a concentration of 1 μg/m^3.

The U.S. EPA derived oral cancer slope factor (CSF) was used to evaluate both oral and dermal exposure to carcinogens. The U.S. EPA's *IRIS* database and the *Health Effects Assessment Summary Tables* served as the primary and secondary sources of the slope factors. Inhalation Unit Risks (from the same sources) were used to evaluate the inhalation exposure pathway for volatile chemicals in the development of GW-2 standards only.

2.3 RELATIVE ABSORPTION FACTORS (RAFs)

The development of the MCP Method 1 Standards used Relative Absorption Factors (RAFs) which have been determined or estimated for each chemical via each route of exposure.

The RAF addresses two major issues:

- the absorption efficiency for the chemical via the route and medium of exposure for which the standard is being developed, and
- the absorption efficiency for the route and medium of exposure in the experimental study which is the basis of the Reference Dose or the Cancer Slope Factor for the chemical in question.

Thus the RAF adjusts the dose (or exposure) estimates based on these ***two*** absorption efficiencies. MA DEQE (1989) and MA DEP (1992) describe the development of RAFs in detail. (The factors were called "*Bioavailability Adjustment Factors*", or "*BAFs*" in the 1989 document.) US EPA (1989a), Appendix A also provides guidance for the "Adjustments For Absorption Efficiency".

2.4 TOXICITY INFORMATION TABLE - Table 2.1.

The following summary table documents the selection and development of individual toxicity values. The list of references is provided at the end of the table.

TABLE 2.1 TOXICITY INFORMATION

TABLE 2-1 TOXICITY INFORMATION & RAFS CHEMICALS	CAS NUMBER	SUBCHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC INHALATION REFERENCE DOSE (OR SUBSTITUTE) ug/cu m	REF	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	CLASS	REF	INHALATION CANCER UNIT RISK 1/(ug/cu m)	CLASS	REF
Acenaphthene	83329	6.0e-01	2	6.0e-02	1								
Acenaphthylene	208968	4.0e-02	2f	4.0e-02	2f				D	1			
Acetone	67641	1.0e+00	2	1.0e-01	1	8.0e+02	3		D	1		D	1
Aldrin	309002	3.0e-05	2	3.0e-05	1			1.70e+01	B2	1	4.9e-03	B2	1
Anthracene	120127	3.0e+00	2	3.0e-01	1				D	1			
Antimony	7440360	4.0e-04	2	4.0e-04	1								
Arsenic	7440382	3.0e-04	2	3.0e-04	1			1.75e+00	A	1f			
Benzene	71432	5.0e-02	4	5.0e-03	4	9.0e+00	3	2.90e-02	A	1	8.3e-06	A	1
Benzo(a)anthracene	56553	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Benzo(a)pyrene	50328	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1	1.7e-03		2
Benzo(b)fluoranthene	205992	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Benzo(g,h,i)perylene	191242	4.0e-02	2f	4.0e-02	2f				D	1			
Benzo(k)fluoranthene	207089	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Beryllium	7440417	5.0e-03	2	5.0e-03	1			4.30e+00	B2	1			
Biphenyl, 1,1-	92524	5.0e-02	2	5.0e-02	1				D	1			
Bis(2-chloroethyl)ether	111444	NA						1.10e+00	B2	1	3.3e-04	B2	1
Bis(2-chloroisopropyl)ether	39638329	4.0e-02	2	4.0e-02	1			7.00e-02	C	2	1.0e-05	C	2
Bis(2-ethylhexyl)phthalate	117817	2.0e-02	2	2.0e-02	1	7.0e+00	3	1.40e-02	B2	1	1.3e-06		chem
Bromodichloromethane	75274	2.0e-02	2	2.0e-02	1			6.20e-02	B2	1			
Bromoform	75252	2.0e-01	2	2.0e-02	1			7.90e-03	B2	1	1.1e-06	B2	1
Bromomethane	74839	1.4e-02	2	1.4e-03	1	5.0e+00	1		D	1			

TABLE 2.1 TOXICITY INFORMATION

TABLE 2-1 TOXICITY INFORMATION & RAFS CHEMICALS	CAS NUMBER	SUBCHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC INHALATION REFERENCE DOSE (OR SUBSTITUTE) ug/cu m	REF	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	CLASS	REF	INHALATION CANCER UNIT RISK 1/(ug/cu m)	CLASS	REF
Cadmium	7440439	5.0e-04	1a,1e	5.0e-04	1a				ND	1			
Carbon tetrachloride	56235	7.0e-03	2	7.0e-04	1	4.3e+02	3	1.30e-01	B2	1	1.5e-05	B2	1
Chlorodane	57749	6.0e-05	2	6.0e-05	1	7.0e-01	3	1.30e+00	B2	1	3.7e-04	B2	1
Chloroanaline, p-	106478	4.0e-03	2	4.0e-03	1								
Chlorobenzene	108907	2.0e-01	2	2.0e-02	1	2.0e+01	2		D	1		D	1
Chloroform	67663	1.0e-02	2	1.0e-02	1	6.6e+02	3	6.10e-03	B2	1	2.3e-05	B2	1
Chlorophenol, 2-	95578	5.0e-02	2	5.0e-03	1								
Chromium (III)	16065831	1.0e+00	2	1.0e+00	1								
Chromium (VI)	18540299	2.0e-02	2	5.0e-03	1				ND	2			
Chrysene	218019	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Cyanide	57125	2.0e-02	2	2.0e-02	1				D	1			
Dibenzo(a,h)anthracene	53703	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Dibromochloromethane	124481	2.0e-01	2	2.0e-02	1			8.40e-02	C	1			
Dichlorobenzene, 1,2- (o-DCB)	95501	9.0e-01	2	9.0e-02	1	2.0e+02	2		D	1			
Dichlorobenzene, 1,3- (m-DCB)	541731	9.0e-01	2a	9.0e-02	1b				D	1			
Dichlorobenzene, 1,4- (p-DCB)	106467	9.0e-01	2a			8.0e+02	2	2.40e-02	C	2			
Dichlorobenzidine, 3,3'-	91941	NA						4.50e-01	B2	1			
DDD	72548	NA						2.40e-01	B2	1			
DDE	72559	NA						3.40e-01	B2	1			
DDT	50293	5.0e-04	2	5.0e-04	1			3.40e-01	B2	1	9.7e-05	B2	1
Dichloroethane, 1,1-	75343	1.0e+00	2	1.0e-01	2	5.0e+02	2		C	1		C	2

TABLE 2.1 TOXICITY INFORMATION

TABLE 2-1 TOXICITY INFORMATION & RAFS CHEMICALS	CAS NUMBER	SUBCHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC INHALATION REFERENCE DOSE (OR SUBSTITUTE) ug/cu m	REF	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	CLASS	REF	INHALATION CANCER UNIT RISK 1/(ug/cu m)	CLASS	REF
Dichloroethane, 1,2-	107062	2.0e-01	4	2.0e-02	4	5.5e+01	3	9.10e-02	B2	1	2.6e-05	B2	2
Dichloroethylene, 1,1-	75354	9.0e-03	2	9.0e-03	1	5.0e+00	3	6.00e-01	C	1	5.0e-05	C	1
Dichloroethylene, cis-1,2-	156592	1.0e-01	2	1.0e-02	2				D	1			
Dichloroethylene, trans-1,2-	156605	2.0e-01	2	2.0e-02	1								
Dichlorophenol, 2,4-	120832	3.0e-03	2	3.0e-03	1								
Dichloropropane, 1,2-	78875	NA				4.0e+00	1	6.80e-02	B2	2	1.9e-05	B2	chem
Dichloropropene, 1,3-	542756	3.0e-03	2	3.0e-04	1	2.0e+01	1	1.80e-01	B2	2	3.7e-05	B2	2
Dieldrin	60571	5.0e-05	2	5.0e-05	1			1.60e+01	B2	1	4.6e-03	B2	1
Diethyl phthalate	84662	8.0e+00	2	8.0e-01	1				D	1			
Dimethyl phthalate	131113	1.0e+00	2	1.0e+01	2				D	1			
Dimethylphenol, 2,4-	105679	2.0e-01	2	2.0e-02	1								
Dinitrophenol, 2,4-	51285	2.0e-03	2	2.0e-03	1								
Dinitrotoluene, 2,4-	121142	2.0e-03	2	2.0e-03	1			6.80e-01	B2	1h			
Dioxin	1746016	NA		NA				1.50e+05	B2	2	3.3e+01	B2	2
Endosulfan	115297	2.0e-04	2	5.0e-05	1j								
Endrin	72208	3.0e-04	2	3.0e-04	1				D	1			
Ethylbenzene	100414	1.0e+00	2	1.0e-01	1	1.0e+03	1		D	1		D	1
Ethylene Dibromide	106934	2.0e-04	4	2.0e-05	4	2.0e-01	4	8.50e+01	B2	1	2.2e-04	B2	1
Fluoranthene	206440	4.0e-01	2	4.0e-02	1				D	1			
Fluorene	86737	4.0e-01	2	4.0e-02	1				D	1			
Heptachlor	76448	5.0e-04	2	5.0e-04	1	7.0e-01	3	4.50e+00	B2	1	1.3e-03	B2	1

TABLE 2.1 TOXICITY INFORMATION

TABLE 2-1 TOXICITY INFORMATION & RAFS CHEMICALS	CAS NUMBER	SUBCHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC INHALATION REFERENCE DOSE (OR SUBSTITUTE) ug/cu m	REF	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	CLASS	REF	INHALATION CANCER UNIT RISK 1/(ug/cu m)	CLASS	REF
Heptachlor Epoxide	1024573	1.3e-05	2	1.3e-05	1			9.10e+00	B2	1	2.6e-03	B2	1
Hexachlorobenzene	118741	8.0e-04	2	8.0e-04	1			1.60e+00	B2	1	4.6e-04	B2	1
Hexachlorobutadiene	87683	2.0e-03	2	2.0e-03	1j			7.80e-02	C	1	2.2e-05	C	1
Hexachlorocyclohexane, gamma	58899	3.0e-03	2	3.0e-04	1			1.30e+00	B2-C	2			
Hexachloroethane	67721	1.0e-02	2	1.0e-03	1	3.0e+00	3	1.40e-02	C	1	4.0e-06	C	2
Indeno(1,2,3-cd)pyrene	193395	4.0e-02	2f	4.0e-02	2f			7.30e+00	B2	1g			
Lead	7439921	7.5e-04	4	7.5e-04	4				B2	1			
Mercury	7439976	3.0e-04	2	3.0e-04	2				D	1			
Methoxychlor	72435	5.0e-03	2	5.0e-03	1				D	1			
Methyl ethyl ketone	78933	5.0e-01	2	6.0e-01	1	1.0e+03	1		D	1		D	1
Methyl isobutyl ketone	108101	5.0e-01	2	5.0e-02	2	8.0e+01	2						
Methyl mercury	22967926	3.0e-04	2	3.0e-04	1								
Methyl tert butyl ether	1634044	5.2e-02	4	1.0e-01	5	5.0e+02	1						
Methylene chloride	75092	6.0e-02	2	6.0e-02	1	3.0e+03	2	7.50e-03	B2	1	4.7e-07	B2	1
Methylnapthalene, 2	91576	4.0e-02	2f	4.0e-02	2f	7.1e+01	3b						
Naphthalene	91203	4.0e-02	2	4.0e-02	2	7.1e+01	3b		D	1		D	1
Nickel	7440020	2.0e-02	2	2.0e-02	1				ND	2			
Pentachlorophenol	87865	3.0e-02	2	3.0e-02	1	7.0e-02	3	1.20e-01	B2	1			
Phenanthrene	85018	4.0e-02	2f	4.0e-02	2f				D	1			
Phenol	108952	6.0e-01	2	6.0e-01	1	2.6e+02	3		D	1			
Polychlorinated biphenyls (PCBs)	1336363	5.0e-06	4	2.0e-05	6	2.0e-02	3	7.70e+00	B2	1			

TABLE 2.1 TOXICITY INFORMATION

TABLE 2-1 TOXICITY INFORMATION & RAFS CHEMICALS	CAS NUMBER	SUBCHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC ORAL REFERENCE DOSE (OR SUBSTITUTE) mg/kg/day	REF	CHRONIC INHALATION REFERENCE DOSE (OR SUBSTITUTE) ug/cu m	REF	ORAL CANCER POTENCY FACTOR 1/(mg/kg/day)	CLASS	REF	INHALATION CANCER UNIT RISK 1/(ug/cu m)	CLASS	REF
Pyrene	129000	3.0e-01	2	3.0e-02	1				D	1			
Selenium	7782492	5.0e-03	2	5.0e-03	1				D	1			
Silver	7440224	5.0e-03	2	5.0e-03	1				D	1			
Styrene	100425	2.0e+00	2	2.0e-01	1	1.0e+03	1	3.00e-02	B2	2k	5.7e-07	B2	2
Tetrachloroethane, 1,1,1,2-	630206	3.0e-02	2	3.0e-02	1			2.60e-02	C	1	7.4e-06	C	1
Tetrachloroethane, 1,1,2,2-	79345	NA		NA		9.3e+01	3	2.00e-01	C	1	5.8e-05	C	1
Tetrachloroethylene	127184	1.0e-01	2	1.0e-02	1	4.6e+03	3	5.20e-03	C-B2	2h	5.2e-07	C-B2	2h
Thallium	7440280	7.0e-04	2	7.0e-05	2								
Toluene	108883	2.0e+00	2	2.0e-01	1	4.0e+02	1		D	1		D	1
Total Petroleum Hydrocarbons	NA	3.0e-01											
Trichlorobenzene, 1,2,4-	120821	1.0e-02	2	1.0e-02	1	9.0e+00	2		D	1			
Trichloroethane, 1,1,1-	71556	9.0e-01	2	9.0e-02	2	1.0e+03	2		D	1		D	1
Trichloroethane, 1,1,2-	79005	4.0e-02	2	4.0e-03	1	7.4e+01	3	5.70e-02	C	1	1.6e-05	C	1
Trichloroethylene	79016	2.0e-02	4	2.0e-03	4	1.8e+02	3	1.10e-02	C-B2	2h	1.7e-06	C-B2	2h
Trichlorophenol, 2,4,5-	95954	1.0e+00	2	1.0e-01	1								
Trichlorophenol, 2,4,6-	88062	NA		NA				1.10e-02	B2	1	3.1e-06	B2	1
Vinyl chloride	75014	1.0e-03	4	1.0e-03	4	1.7e+01	3	1.90e+00	A	2	8.4e-05	A	2
Xylenes (Mixed Isomers)	1330207	4.0e+00	2	2.0e+00	1	3.0e+02	2		D	1		D	1
Zinc	7440666	3.0e-01	2	3.0e-01	1				D	1			

TABLE 2-1 CONTINUED	RELATIVE ABSORPTION FACTORS (RAFs)							
CHEMICALS	RAF, SUB-CHRONIC SOIL INGEST	RAF, SUB-CHRONIC SOIL DERMAL	RAF CHRONIC SOIL INGEST	RAF CHRONIC SOIL DERMAL	RAF CANCER SOIL INGEST	RAF CANCER SOIL DERMAL	RAF CHRONIC WATER INGEST	RAF CANCER WATER INGEST
Acenaphthene	1	0.2	1	0.2	NC	NC	1	NC
Acenaphthylene	0.91	0.18	0.91	0.18	NC	NC	0.91	NC
Acetone	1	0.1	1	0.1	NC	NC	1	NC
Aldrin	1	0.25	1	0.25	1	0.25	1	1
Anthracene	1	0.29	1	0.29	NC	NC	1	NC
Antimony	1	0.1	1	0.1	NC	NC	1	NC
Arsenic	1	0.03	1	0.03	1	0.03	1	1
Benzene	1	0.08	1	0.08	1	0.08	1	1
Benzo(a)anthracene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Benzo(a)pyrene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Benzo(b)fluoranthene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Benzo(g,h,i)perylene	0.91	0.18	0.91	0.18	NC	NC	0.91	NC
Benzo(k)fluoranthene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Beryllium	1	0.03	1	0.03	1	0.03	1	1
Biphenyl, 1,1-	1	0.08	1	0.08	NC	NC	1	NC
Bis(2-chloroethyl)ether	NC	NC	NC	NC	1	1	NC	1
Bis(2-chloroisopropyl)ether	1	1	1	1	1	1	1	1
Bis(2-ethylhexyl)phthalate	1	0.02	1	0.02	1	0.02	1	1
Bromodichloromethane	1	0.1	1	0.1	1	0.1	1	1
Bromoform	1	0.11	1	0.11	1	0.1	1	1
Bromomethane	1	0.1	1	0.1	NC	NC	1	NC
Cadmium	1	0.14	1	0.14	NC	NC	1	NC

TABLE 2-1 CONTINUED	RELATIVE ABSORPTION FACTORS (RAFs)							
CHEMICALS	RAF, SUB-CHRONIC SOIL INGEST	RAF, SUB-CHRONIC SOIL DERMAL	RAF CHRONIC SOIL INGEST	RAF CHRONIC SOIL DERMAL	RAF CANCER SOIL INGEST	RAF CANCER SOIL DERMAL	RAF CHRONIC WATER INGEST	RAF CANCER WATER INGEST
Carbon tetrachloride	1	0.1	1	0.1	1	0.1	1	1
Chlorodane	1	0.05	1	0.05	1	0.05	1	1
Chloroanaline, p-	1	0.1	1	0.1	NC	NC	1	NC
Chlorobenzene	1	0.1	1	0.1	NC	NC	1	NC
Chloroform	1	0.1	1	0.1	1	0.1	1	1
Chlorophenol, 2-	1	0.26	1	0.26	NC	NC	1	NC
Chromium (III)	1	0.04	1	0.04	NC	NC	1	NC
Chromium (VI)	1	0.09	1	0.09	NC	NC	1	NC
Chrysene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Cyanide	1	0.3	1	0.3	NC	NC	1	NC
Dibenzo(a,h)anthracene	0.91	0.08	0.91	0.08	1	0.09	0.91	1
Dibromochloromethane	1	0.1	1	0.1	1	0.1	1	1
Dichlorobenzene, 1,2- (o-DCB)	1	0.1	1	0.1	NC	NC	1	NC
Dichlorobenzene, 1,3- (m-DCB)	NC	NC	1	0.1	NC	NC	1	NC
Dichlorobenzene, 1,4- (p-DCB)	NC	NC	1	0.1	1	0.1	NC	1
Dichlorobenzidine, 3,3'-	NC	NC	NC	NC	1	0.54	NC	1
DDD	NC	NC	NC	NC	1	0.2	NC	1
DDE	NC	NC	NC	NC	1	0.2	NC	1
DDT	1	0.2	1	0.2	1	0.2	1	1
Dichloroethane, 1,1-	1.3	0.13	1.3	0.13	NC	NC	1.3	NC
Dichloroethane, 1,2-	1	0.1	1	0.1	1	0.1	1	1
Dichloroethylene, 1,1-	1	0.1	1	0.1	1.02	0.102	1	1.02

TABLE 2-1 CONTINUED	RELATIVE ABSORPTION FACTORS (RAFs)							
CHEMICALS	RAF, SUB-CHRONIC SOIL INGEST	RAF, SUB-CHRONIC SOIL DERMAL	RAF CHRONIC SOIL INGEST	RAF CHRONIC SOIL DERMAL	RAF CANCER SOIL INGEST	RAF CANCER SOIL DERMAL	RAF CHRONIC WATER INGEST	RAF CANCER WATER INGEST
Dichloroethylene, cis-1,2-	1	0.1	1	0.1	NC	NC	1	NC
Dichloroethylene, trans-1,2-	1	0.1	1	0.1	NC	NC	1	NC
Dichlorophenol, 2,4-	1	0.4	1	0.4	NC	NC	1	NC
Dichloropropane, 1,2-	NC	NC	NC	NC	1	0.2	NC	1
Dichloropropene, 1,3-	1	0.2	1	0.2	1	0.2	1	1
Dieldrin	1	0.25	1	0.25	1	0.25	1	1
Diethyl phthalate	1	0.02	1	0.02	NC	NC	1	NC
Dimethyl phthalate	1	0.07	1	0.07	NC	NC	1	NC
Dimethylphenol, 2,4-	1	0.26	1	0.26	NC	NC	1	NC
Dinitrophenol, 2,4-	1	0.26	1	0.26	NC	NC	1	NC
Dinitrotoluene, 2,4-	1	0.13	1	0.13	1	0.13	1	1
Dioxin	NC	NC	NC	NC	1	0.2	NC	1
Endosulfan	1	0.2	1	0.2	NC	NC	1	NC
Endrin	1	0.25	1	0.25	NC	NC	1	NC
Ethylbenzene	1	0.2	1	0.2	NC	NC	1	NC
Ethylene Dibromide	1	0.1	1	0.1	1	0.1	1	1
Fluoranthene	1	0.2	1	0.2	NC	NC	1	NC
Fluorene	1	0.2	1	0.2	NC	NC	1	NC
Heptachlor	1	0.2	1	0.2	1	0.2	1	1
Heptachlor Epoxide	1	0.2	1	0.2	1	0.2	1	1
Hexachlorobenzene	1	0.13	1	0.13	1	0.13	1	1
Hexachlorobutadiene	1	0.2	1	0.2	1	0.2	1	1

TABLE 2-1 CONTINUED	RELATIVE ABSORPTION FACTORS (RAFs)							
CHEMICALS	RAF, SUB-CHRONIC SOIL INGEST	RAF, SUB-CHRONIC SOIL DERMAL	RAF CHRONIC SOIL INGEST	RAF CHRONIC SOIL DERMAL	RAF CANCER SOIL INGEST	RAF CANCER SOIL DERMAL	RAF CHRONIC WATER INGEST	RAF CANCER WATER INGEST
Hexachlorocyclohexane, gamma	1	0.2	1	0.2	1	0.2	1	1
Hexachloroethane	1	1	1	1	1	1	1	1
Indeno(1,2,3 cd)pyrene	0.91	0.18	0.91	0.18	1	0.2	0.91	1
Lead	0.5	0.006	0.5	0.006	NC	NC	0.5	NC
Mercury	1	0.05	1	0.05	NC	NC	1	NC
Methoxychlor	1	0.2	1	0.2	NC	NC	1	NC
Methyl ethyl ketone	1	0.1	1	0.1	NC	NC	1	NC
Methyl isobutyl ketone	1	0.1	1	0.1	NC	NC	1	NC
Methyl mercury	1	0.2	1	0.2	NC	NC	1	NC
Methyl tert butyl ether	1	0.1	1	0.1	NC	NC	1	NC
Methylene chloride	1	0.1	1	0.1	1	0.1	1	1
Methylnapthalene, 2	1	0.1	1	0.1	NC	NC	1	NC
Naphthalene	1	0.1	1	0.1	NC	NC	1	NC
Nickel	1	0.35	1	0.35	NC	NC	1	NC
Pentachlorophenol	1	0.11	1	0.11	1	0.11	1	1
Phenanthrene	0.91	0.18	0.91	0.18	NC	NC	0.91	NC
Phenol	1	0.26	1	0.26	NC	NC	1	NC
Polychlorinated biphenyls (PCBs)	0.85	0.067	0.85	0.067	0.85	0.067	1	1
Pyrene	1	0.2	1	0.2	NC	NC	1	NC
Selenium	1	0.002	1	0.002	NC	NC	1	NC
Silver	1	0.25	1	0.25	NC	NC	1	NC
Styrene	1	0.2	1	0.2	1	0.2	1	1

TABLE 2-1 CONTINUED	RELATIVE ABSORPTION FACTORS (RAFs)							
CHEMICALS	RAF, SUB-CHRONIC SOIL INGEST	RAF, SUB-CHRONIC SOIL DERMAL	RAF CHRONIC SOIL INGEST	RAF CHRONIC SOIL DERMAL	RAF CANCER SOIL INGEST	RAF CANCER SOIL DERMAL	RAF CHRONIC WATER INGEST	RAF CANCER WATER INGEST
Tetrachloroethane, 1,1,1,2-	1	1.4	1	1.4	1	1.4	1	1
Tetrachloroethane, 1,1,2,2-	NC	NC	NC	NC	1	1.4	NC	1
Tetrachloroethylene	1	0.1	1	0.1	1	0.1	1	1
Thallium	1	0.01	1	0.01	NC	NC	1	NC
Toluene	1	0.12	1	0.12	NC	NC	1	NC
Total Petroleum Hydrocarbons	1	1	1	1	NC	NC		
Trichlorobenzene, 1,2,4-	1	0.08	1	0.08	NC	NC	1	NC
Trichloroethane, 1,1,1-	1	0.1	1	0.1	NC	NC	1	NC
Trichloroethane, 1,1,2-	1	1	1	1	1	1	1	1
Trichloroethylene	1	0.1	1	0.1	1	0.1	1	1
Trichlorophenol, 2,4,5-	1	0.26	1	0.26	NC	NC	1	NC
Trichlorophenol, 2,4,6-	NC	NC	NC	NC	1	0.26	NC	1
Vinyl chloride	1	0.1	1	0.1	1.53	0.16	1	1.53
Xylenes (Mixed Isomers)	1	0.12	1	0.12	NC	NC	1	NC
Zinc	1	0.02	1	0.02	NC	NC	1	NC

References for Toxicity Values and Constants on Spreadsheet

Reference #	Description
1.	U.S. EPA, Integrated Risk Information System (IRIS). On-line search: current as of July 1, 1993.
1.a.	The chronic oral RfD for drinking water (from IRIS) is listed here as the oral RfD for cadmium.
1.b.	The chronic oral RfD for 1,2-Dichlorobenzene has been used as the chronic oral RfD equivalent fr 1,3-Dichlorobenzene.
1.e.	The chronic oral RfD (from IRIS) has been used here as a subchronic oral RfD equivalent.
1.f.	This oral Cancer Slope Factor equivalent for arsenic is back-calculated from a drinking water Unit Risk Value from IRIS.
1.g.	This Cancer Slope Factor or Unit Risk for benzo(a)pyrene (from IRIS) has been applied to the seven PAH compounds which are designated as category A, B1, B2 or C carcinogens.
1.h.	The oral cancer slope factor for a mix of 2,4- and 2,6- Dinitrotoluene (from IRIS) has been used as the cancer slope factor equivalent for pure 2,4-Dinitrotoluene.
1.j.	This value was recently withdrawn form IRIS, although many consultants may continue to use it, lacking any new information.
2.	U.S. EPA Health Effects Assessment Summary Tables (HEAST), Annual FY-1992. (OERR 9200.6-303 (92-1), NTIS No. PB92-921199) January/July 1992.
2.a.	This subchronic oral RfD (from HEAST) for 1,2-Dichlorobenzene has been used as the subchronic oral RfD equivalent for 1,3- and 1,4- Dichlorobenzene.
2.b.	This subchronic oral RfD (from HEAST) for naphthalene has been used as the subchronic oral RfD equivalent for all PAH compounds for which subchronic oral RfDs are unavailable.
2.d.	Note!! HEAST lists TWO oral RfDs. Call for more information.
2.f.	The chronic oral RfD for naphthalene (from HEAST) has been used as the chronic RfD equivalent for all PAH compounds for which chronic oral RfDs are unavailable.
2.h.	This Cancer Slope Factor or Unit Risk was taken from a fact sheet distributed by the U.S. EPA Superfund Health Risk Technical Support Center at ECAO-Cincinnati, current as of September 2, 1992.
2.j.	HEAST has adopted the IRIS chronic oral RfD as the subchronic oral RfD.
2.k.	This value has been withdrawn from HEAST, although many consultants may continue to use it, lacking any new information. Consult HEAST for any additional information.
3.	Allowable Threshold Concentrations (ATCs) from MA DEQE (1989a), Guidance for Disposal Site Risk Characterization and Related Phase II Activities - In Support of the Massachusetts Contingency Plan.
3.b.	The ATC for "total concentration of naphthalene and 2-methylnaphthalene" is used here as the ATC for this chemical.

3.c. The chronic inhalation ATC for naphthalene has been used as the chronic inhalation RfC equivalent for all PAH compounds for which chronic inhalation RfCs are unavailable.

4. Developed for the *Risk Assessment ShortForm - Residential Scenario* (MA DEP, 1992) by MA DEP staff. Documentation of this value may be found in that document.

5. The chronic oral RfD for Methyl tert-Butyl Ether is based on Drinking Water Guidelines promulgated by the ORS in October, 1992.

6. The chronic oral RfD for Arachlor 1254, developed by DEP ORS in a May 10, 1993 memo, has been used as the chronic oral RfD for PCBs as a group.

SES These values have been developed using the SESOIL model.

NA Not Available

NC Not Calculated.

10. Owen, 1990. "Literature Derived Absorption Coefficients for 39 Chemicals via Oral and Inhalation Routes of Exposure"; Regulatory Toxicology and Pharmacology; pp. 237-252; November, 1990.

11. United States Environmental Protection Agency (USEPA), 1986. "Superfund Public Health Evaluation Manual"; U.S. Environmental Protection Agency; Office of Emergency and Remedial Response, EPA/540/1-86/060 (OSWER Directive 9285.4-1); Washington, D.C., October 1986.

12. USEPA, 1992. "Dermal Exposure Assessment: Principles and Applications"; U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/8-91/011B; Washington, D.C., January 1992.

13. ATSDR, "Toxicological Profile for ____________"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. The ATSDR profile for the chemical of interest was used as a source of this value.

14. USEPA Test Methods for Evaluating Solid Waste, SW-846, Third Edition (Revision O), November 1986.
14.a. USEPA Method 8240.
14.b. USEPA Method 8080.
14.c. USEPA Method 8270.
14.d. USEPA Method 6010.
14.e. USEPA Method 525.1.
14.f. USEPA Method 524.1.
14.g. USEPA Method 524.2.
14.h. USEPA Method 7196.
14.i. USEPA Method 7470.

15. Guide to Environmental Analytical Methods, Robert E. Wagner, editor; Genium Publishing Corporation, Schenectady, NY; 1992.
15.a. USEPA Method 335.

15.b. USEPA Method 200.7.
15.c. USEPA Method 508.
15.d. USEPA Method 625.

16. From CLP Statement of Work for Inorganic Analytes, 8/90, Document Number ILM01.1

17. Standard Methods for the Examination of Water and Wastewater, 17th edition; Water Environment Federation.

18. Federal Register 40 CFR 141:23:3579 (January 30, 1991).

19. USEPA Method 1613.

20. U.S. Department of Defense, 1989

21. U.S. EPA Draft Health Advisory for Methyl t-Butyl Ether, 1989.

22. Oregon Department of Environmental Quality, Development of Generic Soil Cleanup Levels Based On Analysis Of The Leachate Pathway, May 12, 1992.

23. See Appendix G: Application of SESOIL Model

24. Handbook of Environmental Data on Organic Chemicals, 2nd edition, Karel Verschueren; Van Nostrand Reinhold Co. Inc., NY; 1983.

25. Compilation of Odor and Taste Threshold Values Data, F.A. Fazzalari, editor; ASTM Data Service DS48A; 1978.

27. USEPA, 1992. "Reference Guide to Odor Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendment of 1990", U.S. Environmental Protection Agency; Office of Research and Development, EPA/600/R-92/047; Washington, D.C., March 1992.

28. USEPA, 1992. "Indoor Air Quality Database for Organic Compounds", U.S. Environmental Protection Agency; Research Triangle Park, NC, February 1992.

29. Risk Reduction Engineering Laboratory (RREL) Treatability Database, Version 4.0.

30. U.S. Department of Defense, 1991. "Defense Priority Model Users Manual", FY 1992 version; Washington, D.C.

calc Calculated value

TABLE 3-1 PQLs, BACKGROUND, SOLUBILITY, ODOUR DATA AND OTHER PHYSICAL CONSTANTS

CHEMICALS	CAS NUMBER	SOIL BACK-GROUND mg/kg	GROUND WATER BACK-GROUND ug/L	INDOOR AIR BACK-GROUND ug/cu m	SOIL PQL mg/kg	REF	WATER PQL ug/L	REF	ODOR THRESHOLD ug/m3	ppm	REF
Acenaphthene	83329	0.5	0		0.66	14c	10	14c		0.08	13
Acenaphthylene	208968	0.5	0		0.66	14c	0.5	14e			
Acetone	67641			6	0.1	14a	100	14a	30862	13	13
Aldrin	309002				0.00268	14b	0.5	14e	263		28
Anthracene	120127	0.5	0		0.66	14c	0.5	14e			
Antimony	7440360				6.4	14d	32	15b			
Arsenic	7440382	32	5.5		10.6	14d	50	17			
Benzene	71432	0	0	21	0.005	14a	0.5	14f	4890	1.5	13
Benzo(a)anthracene	56553	0.5	0		0.66	14c	1	14e			
Benzo(a)pyrene	50328	0.5	0		0.66	14c	0.5	14e			
Benzo(b)fluouranthene	205992	0.5	0		0.66	14c	1	14e			
Benzo(g,h,i)perylene	191242	0.5	0		0.66	14c	0.5	14e			
Benzo(k)fluoranthene	207089	0.5	0		0.66	14c	1	14e			
Beryllium	7440417				0.06	14d	0.3	15b			
Biphenyl, 1,1-	92524				0.05	14c	0.1	14e	60	9.5e-03	27
Bis(2-chloroethyl)ether	111444				0.66	14c	28.5	15d	287	4.9e-02	13
Bis(2-chloroisopropyl)ether	39638329				0.66	14c	28.5	15d	2240	0.32	24
Bis(2-ethylhexyl)phthalate	117817				0.66	14c	4	14e			
Bromodichloromethane	75274				0.005	14a	2.5	14f			
Bromoform	75252				0.005	14a	3.5	14f	13450	1.3	13
Bromomethane	74839				0.01	14a	0.55	14g	80000	20	13
Cadmium	7440439		4.2		0.8	14d	4	15b			

TABLE 3-1 PQLs, BACKGROUND, SOLUBILITY, ODOUR DATA AND OTHER PHYSICAL CONSTANTS

CHEMICALS	CAS NUMBER	SOIL BACK-GROUND mg/kg	GROUND WATER BACK-GROUND ug/L	INDOOR AIR BACK-GROUND ug/cu m	SOIL PQL mg/kg	REF	WATER PQL ug/L	REF	ODOR THRESHOLD ug/m3	ppm	REF
Carbon tetrachloride	56235	0	0	1	0.005	14a	1.5	14f	63000	10	13
Chlordane	57749				0.00938	14b	1.5	14e	8.4		28
Chloroaniline, p-	106478				1.3	14c	20	14c			
Chlorobenzene	108907	0	0	10	0.005	14c	0.5	14f	1000	0.22	13
Chloroform	67663	0	0	3	0.005	14a	1	14f	421600	85	13
Chlorophenol, 2-	95578				0.66	14c	10	14c	19	3.6e-03	24
Chromium (III)	16065831				1.4	14d	7	14d			
Chromium (VI)	18540299	105			0	14h	0.5	14h			
Chrysene	218019	0.5	0		0.66	14c	1.5	14e			
Cyanide	57125	0	0		1	16	0.1	15a	652	0.58	13
Dibenzo(a,h)anthracene	53703	0.5	0		0.66	14c	0.5	14e			
Dibromochloromethane	124481				0.005	14a	2	14f			
Dichlorobenzene, 1,2- (o-DCB)	95501			1	0.66	14c	5	14f	305000	50	24
Dichlorobenzene, 1,3- (m-DCB)	541731				0.66	14c	0.6	14g			
Dichlorobenzene, 1,4- (p-DCB)	106467			0.5	0.66	14c	0.2	14g	1100	0.18	13
Dichlorobenzidine, 3,3'-	91941				1.3	14c	82.5	15d			
DDD	72548				0.00737	14b	0.0125	15c			
DDE	72559				0.00268	14b	0.05	15c			
DDT	50293				0.00804	14b	0.3	15c			
Dichloroethane, 1,1-	75343	0	0		0.005	14a	1	14f	125000	500	13
Dichloroethane, 1,2-	107062	0	0		0.005	14a	1	14f	2424	6	13
Dichloroethylene, 1,1-	75354	0	0		0.005	14a	1	14f	125000	500	13

TABLE 3-1 PQLs, BACKGROUND, SOLUBILITY, ODOUR DATA AND OTHER PHYSICAL CONSTANTS

CHEMICALS	CAS NUMBER	SOIL BACK-GROUND mg/kg	GROUND WATER BACK-GROUND ug/L	INDOOR AIR BACK-GROUND ug/cu m	SOIL PQL mg/kg	REF	WATER PQL ug/L	REF	ODOR THRESHOLD ug/m3	ppm	REF
Dichloroethylene, cis-1,2-	156592				0.005	14a	0.6	14g			
Dichloroethylene, trans-1,2-	156605				0.005	14a	0.3	14g	67320	17	13
Dichlorophenol, 2,4-	120832				0.66	14c	13.5	15d	1400.7	0.21	13
Dichloropropane, 1,2-	78875				0.005	14a	1	14f	1190.5	0.25	13
Dichloropropene, 1,3-	542756				0.005	14a	5	14a	4610	1	13
Dieldrin	60571				0.00134	14b	0.1	15c			
Diethylphthalate	84662				0.66	14c	4	14e			
Dimethylphthalate	131113				0.66	14c	1.5	14e			
Dimethylphenol, 2,4-	105679				0.66	14c	13.5	15d	1		24
Dinitrophenol, 2,4-	51285				3.3	14c	210	15d			
Dinitrotoluene, 2,4-	121142				0.66	14c	28.5	15d			
Dioxin	1746016				1.0e-06	19	1e-05	19			
Endosulfan	115297				0.00938	14b	0.12	15c			
Endrin	72208				0.00402	14b	5	14e			
Ethylbenzene	100414	0	0	10	0.005	14a	0.3	14g	2000	2.3	13
Ethylene dibromide	106934	0	0		0.005	14a	0.3	14g	200000	26	24
Fluoranthene	206440	0.5	0		0.66	14c	11	15d			
Fluorene	86737	0.5	0		0.66	14c	1	14e			
Heptachlor	76448				0.00201	14b	1	14e	300	0.02	13
Heptachlor epoxide	1024573				0.05561	14b	1.5	14e	300	0.019	13
Hexachlorobenzene	118741				0.66	14c	1	14e			
Hexachlorobutadiene	87683				0.66	14c	0.55	14g	12000		13

TABLE 3-1 PQLs, BACKGROUND, SOLUBILITY, ODOUR DATA AND OTHER PHYSICAL CONSTANTS

CHEMICALS	CAS NUMBER	SOIL BACK-GROUND mg/kg	GROUND WATER BACK-GROUND ug/L	INDOOR AIR BACK-GROUND ug/cu m	SOIL PQL mg/kg	REF	WATER PQL ug/L	REF	ODOR THRESHOLD ug/m3	ppm	REF
Hexachlorocyclohexane, gamma	58899				0.00268	14b	0.5	14e			
Hexachloroethane	67721				0.66	14b	8	15d			
Indeno(1,2,3-cd)pyrene	193395	0.5	0		0.66	14c	0.5	14e			
Lead	7439921	69	8.8		8.4	14d	1	15b			
Mercury	7439976	1	0.95		0.1	14i	0.2	14i			
Methoxychlor	72435				0.11792	14b	1.5	14e			
Methyl ethyl ketone	78933	0	0	42	0.1	14a	100	14a	32000	11	24
Methyl isobutyl ketone	108101			2	0.05	14a	50	14a	9700	0.1	25
Methyl mercury	22967926				0						
Methyl tert butyl ether	1634044	0	0		0.05	14f	0.5	14f			
Methylene chloride	75092	0	0	600	0.005	14a	5	14f	540000	160	13
Methylnaphthalene, 2-	91576	0.5	0		0.66	14c	10	14c	68		28
Naphthalene	91203	0.5	0	5	0.66	14c	0.2	14g	440	0.084	13
Nickel	7440020	30			3	14d	15	15b			
Pentachlorophenol	87865				3.3	14c	15	14e			
Phenanthrene	85018	0.5	0		0.66	14c	1	14e	55		24
Phenol	108952	0	0		0.66	14c	10	14c	156.8	0.04	13
Polychlorinated biphenyls (PCBs)	1336363	0	0		0.04355	14b	0.325	14b			
Pyrene	129000	0.5	0		0.66	14c	0.5	14e			
Selenium	7782492				15	14d	75	15b			
Silver	7440224		4.7		1.4	14d	7	15b			
Styrene	100425			5	0.005	14a	0.3	14g	1360	0.3	13

TABLE 3-1 PQLs, BACKGROUND, SOLUBILITY, ODOUR DATA AND OTHER PHYSICAL CONSTANTS

CHEMICALS	CAS NUMBER	SOIL BACK-GROUND mg/kg	GROUND WATER BACK-GROUND ug/L	INDOOR AIR BACK-GROUND ug/cu m	SOIL PQL mg/kg	REF	WATER PQL ug/L	REF	ODOR THRESHOLD ug/m3	ppm	REF
Tetrachloroethane, 1,1,1,2-	630206				0.005	14a	5	14a			
Tetrachloroethane, 1,1,2,2-	79345			0.01	0.005	14a	2	14f	10470	1.5	13
Tetrachloroethylene	127184	0	0	11	0.005	14a	1.5	14f	31730	4.68	13
Thallium	7440280				8	14d	40	15b			
Toluene	108883	0	0	29	0.005	14a	0.5	14f	30000	8	13
Total Petroleum Hydrocarbons	NA				0						
Trichlorobenzene, 1,2,4-	120821			0.04	0.66	14c	1	14g	22000	2.96	27
Trichloroethane, 1,1,1-	71556	0	0	30	0.005	14a	1.5	14f	65127	120	13
Trichloroethane, 1,1,2-	79005			30	0.005	14a	0.5	14g			
Trichloroethylene	79016	0	0	5	0.005	14a	2	14f	1360000		28
Trichlorophenol, 2,4,5-	95954				0.66	14c	10	14c			
Trichlorophenol 2,4,6-	88062				0.66	14c	10	14c	0.3	2.6e-03	13
Vinyl chloride	75014	0	0		0.01	14a	1.5	14f	771244	3000	13
Xylenes (Mixed Isomers)	1330207	0	0	3	0.005	14a	2.5	14f	441	0.1	13
Zinc	7440666	110			0.4	14d	2	15b			

TABLE 3-1 CONTINUED

CHEMICALS	VAPOUR PRESSURE Torr @20-30C	REF	ODOUR INDEX	SOLUBILITY ug/L	REF	HENRY'S LAW CONSTANT atm-m3/mol	REF	LOG Kow	REF	Koc mg/L	REF	MOLECULAR WEIGHT g/mole	REF
Acenaphthene				3.42e+03	29	2.41e-04	29	3.98	13	4.6e+03	13	154	13
Acenaphthylene	2.9e-02	13		3.93e+03	13	1.45e-03	13	4.07	13	2.5e+03	13	154	13
Acetone	270	29	20.77	1.00e+09	11	4.26e-05	13	-0.24	13	5.4e+00	13	58	13
Aldrin	2.3e-05	29	5.87e-06	1.70e+01	29	4.96e-04	29	3.01	13	4.9e+04	13	365	13
Anthracene	1.7e-05	13		1.29e+03	29	8.60e-05	29	4.45	13	1.4e+04	13	178	13
Antimony				-		-	-	-	-	-	-	122	13
Arsenic				-		-	-	-	-	-	-	75	13
Benzene	95	29	63.33	1.78e+06	SES	5.50e-03	SES	2.13	13	8.3e+01	SES	78	13
Benzo(a)anthracene	5.0e-09	29		1.00e+01	29	1.00e-06	13	5.61	13	2.0e+05	13	228	13
Benzo(a)pyrene	5.0e-09	29		3.80e+00	29	4.90e-07	29	6.06	13	5.5e+06	13	252	13
Benzo(b)fluouranthene				1.40e+01	11	1.22e-05	13	6.06	13	5.5e+05	13	252	13
Benzo(g,h,i)perylene	1.0e-10	29		2.60e-01	29	1.44e-07	13	6.51	13	1.6e+06	13	276	13
Benzo(k)fluoranthene	9.59e-11	29		8.00e-01	20	3.87e-05	13	6.06	13	5.5e+05	11	252	13
Beryllium				-		-	-	-	-	-	-	9	13
Biphenyl, 1,1-				7.50e+03	29	4.08e-04	29	-	-			154	11
Bis(2-chloroethyl)ether	7.1e-01	29	14.49	1.02e+07	29	1.30e-05	29	1.58	13	1.3e+01	13	143	13
Bis(2-chloroisopropyl)ether	8.5e-01	24	2.66	1.70e+06	11	1.13e-04	11	2.1	11	6.1e+01	11	171	11
Bis(2-ethylhexyl)phthalate				1.30e+03	29	3.00e-07	29	5.11	13	1.0e+05	13	391	13
Bromodichloromethane	50	29		4.50e+06	13	2.12e-03	29	2.1	13	6.3e+01	13	164	13
Bromoform	5.6	29	4.31	3.20e+06	29	5.32e-04	29	2.38	13	1.1e+02	13	253	13
Bromomethane	1420	29	71.00	1.75e+07	29	1.97e-01	13	1.1	13	5.9e+00	13	95	13
Cadmium				-		-	-	-	-	-	-	112	13

TABLE 3-1 CONTINUED

CHEMICALS	VAPOUR PRESSURE Torr @20-30C	REF	ODOUR INDEX	SOLUBILITY ug/L	REF	HENRY'S LAW CONSTANT atm-m3/mol	REF	LOG Kow	REF	Koc mg/L	REF	MOLECULAR WEIGHT g/mole	REF
Carbon tetrachloride	113	29	11.30	8.00e+05	29	2.93e-02	29	2.64	13	1.1e+02	13	154	13
Chlordane	1.0e-05	29	7.12e-05	5.60e+01	29	4.79e-05	29	5.54	13	4.4e+04	13	410	13
Chloroaniline, p-	1.5e-02	29		2.60e+06	20	3.31e-07	20	1.83	20	6.4e+01	calc	128	20
Chlorobenzene	11.8	29	53.64	4.88e+05	29	3.93e-03	29	2.84	13	3.3e+02	13	113	13
Chloroform	160	29	1.88	9.30e+06	29	3.39e-03	29	1.97	13	3.1e+01	11	119	13
Chlorophenol, 2-				2.85e+07	29	1.03e-05	29	2.15	12	1.1e+02	calc	129	20
Chromium (III)				-		-	-	-	-	-	-	52	13
Chromium (VI)				-		-	-	-	-	-	-	52	13
Chrysene	6.3e-09	29		6.00e+00	29	1.05e-06	29	5.61	13	2.0e+05	13	228	13
Cyanide	620	24	1068.97	1.000e+09	11	1.90e+03	20	0.66	13	9.2e+00	calc	27	13
Dibenzo(a,h)anthracene	1.0e-10	13		5.00e-01	29	7.30e-08	29	6.84	13	3.3e+06	13	278	13
Dibromochloromethane	76	13		4.00e+06	13	7.83e-04	29	2.24	13	8.3e+01	13	208	13
Dichlorobenzene, 1,2- (o-DCB)	1.5	29	0.03	1.45e+05	29	1.94e-03	29	3.38	12	1.7e+03	11	147	11
Dichlorobenzene, 1,3- (m-DCB)				1.23e+05	29	2.63e-03	29	3.6	12	1.7e+03	11	147	11
Dichlorobenzene, 1,4- (p-DCB)	1.8	29	10.00	7.90e+04	29	2.72e-03	29	3.52	13	1.8e+03	13	147	13
Dichlorobenzidine, 3,3'-	4.5e-09	13		3.10e+03	29	8.33e-07	11	3.51	12	1.6e+03	11	253	11
DDD	1.0e-06	29		1.60e+02	29	7.96e-06	11	6.2	13	7.8e+05	13	320	13
DDE	6.5e-06	29		4.00e+01	29	6.80e-05	13	7	13	4.4e+06	13	318	13
DDT	1.5e-07	29		3.10e+00	29	3.89e-05	29	6.19	13	2.4e+05	13	354	13
Dichloroethane, 1,1-	234	29	0.47	5.50e+06	29	5.45e-03	29	1.79	13	5.8e+01	13	99	13
Dichloroethane, 1,2-	79	29	13.17	8.69e+06	29	1.10e-03	29	1.48	13	1.4e+01	13	99	13
Dichloroethylene, 1,1-	591	29	1.18	2.10e+05	29	1.49e-02	29	2.13	13	6.5e+01	13	97	13

TABLE 3-1 CONTINUED

CHEMICALS	VAPOUR PRESSURE Torr @20-30C	REF	ODOUR INDEX	SOLUBILITY ug/L	REF	HENRY'S LAW CONSTANT atm-m3/mol	REF	LOG Kow	REF	Koc mg/L	REF	MOLECULAR WEIGHT g/mole	REF
Dichloroethylene, cis-1,2-	202	29		8.00e+05	29	4.08e-03	29	1.86	13	4.9e+01	13	97	13
Dichloroethylene, trans-1,2-	331	29	19.47	6.00e+05	29	5.32e-03	29	2.09	13	4.9e+01	13	97	13
Dichlorophenol, 2,4-	6.7e-02	13	0.32	4.50e+06	29	2.80e-06	29	2.92	13	6.0e+03	13	163	13
Dichloropropane, 1,2-	42	29	168.00	2.70e+06	29	2.82e-03	29	1.99	13	4.7e+01	13	113	13
Dichloropropene, 1,3-	43	29	43.00	2.70e+06	29	3.50e-03	29	1.6	13	2.6e+01	13	111	13
Dieldrin	1.8e-07	29		1.86e+02	29	5.84e-05	29	4.55	13	7.4e+03	13	381	29
Diethylphthalate				8.96e+05	11	1.14e-06	11	2.47	12	1.4e+02	11	222	11
Dimethylphthalate				5.00e+06	29	1.05e-07	20	1.56	12	1.4e+02	calc	194	29
Dimethylphenol, 2,4-				7.87e+06	20	1.70e-05	29	2.3	12	4.0e+01	calc	122	29
Dinitrophenol, 2,4-				5.60e+06	29	6.45e-10	29	1.54	12	1.7e+01	11	184	11
Dinitrotoluene, 2,4-	5.1e-03	13		2.70e+05	29	4.50e-06	13	2	13	4.5e+01	13	182	13
Dioxin	7.4e-10	29		1.93e-02	29	2.10e-03	29	6.8	12	3.3e+06	11	322	11
Endosulfan	1.0e-05	13		1.50e+02	13	1.00e-05	13	3.62	13	3.2e+03	13	407	13
Endrin	2.0e-07	29		2.60e+02	29	4.00e-07	29	5.338	13	1.7e+03	13	381	13
Ethylbenzene	10	29	4.35	1.61e+05	SES	3.43e-03	SES	3.13	13	5.8e+02	SES	106	13
Ethylene dibromide	12	29	0.46	4.30e+06	29	6.73e-04	11	1.96	13	4.4e+01	11	188	11
Fluoranthene	5.0e-06	13		2.65e+02	29	6.50e-06	29	4.9	13	3.8e+04	13	202	13
Fluorene				1.90e+03	29	1.17e-04	29	4.18	13	7.3e+03	13	166	13
Heptachlor	3.0e-04	29	0.01	5.60e+01	29	1.48e-03	29	5.44	13	2.2e+04	13	374	13
Heptachlor epoxide	2.6e-06	13	1.37e-04	3.50e+02	29	3.16e-05	29	5.4	13	2.3e+04	13	389	13
Hexachlorobenzene	1.09e-05	13		1.10e+02	29	1.70e-03	29	6.18	13	1.2e+06	13	285	13
Hexachlorobutadiene	0.15	29	1.17e-03	2.00e+03	29	2.56e-02	29	4.78	12	2.9e+04	11	261	11

TABLE 3-1 CONTINUED

CHEMICALS	VAPOUR PRESSURE Torr @20-30C	REF	ODOUR INDEX	SOLUBILITY ug/L	REF	HENRY'S LAW CONSTANT atm-m3/mol	REF	LOG Kow	REF	Koc mg/L	REF	MOLECULAR WEIGHT g/mole	REF
Hexachlorocyclohexane, gamma	9.4e-06	29		7.00e+03	29	4.93e-07	29	3.61	13	3.7e+03	13	291	13
Hexachloroethane	0.4	29		5.00e+04	29	9.85e-03	29	3.93	12	2.0e+04	11	237	11
Indeno(1,2,3-cd)pyrene	1.0e-09	13		5.30e-01	11	6.95e-08	29	6.58	13	1.6e+06	13	276	13
Lead				-		-	-	-	-	-	-	207	11
Mercury	1.2e-03	29		5.60e+01	29	-	29	-	-	-	-	201	13
Methoxychlor	1.4e-06	13		4.00e+01	29	1.60e-05	13	5.08	13	7.9e+04	13	346	13
Methyl ethyl ketone	100	29	9.09	2.75e+08	29	2.74e-05	11	0.29	13	3.5e+00	13	72	13
Methyl isobutyl ketone	10	29	100.00	1.91e+07	29	1.38e-04	20	1.19	20	3.1e+00	calc	100	11
Methyl mercury				-		-	-	-	-	-	-	231	29
Methyl tert butyl ether	245	29		4.80e+07	29	5.91e-04	calc	1.05	21	2.7e+01	calc	88	29
Methylene chloride	429	29	2.68	1.67e+07	29	3.19e-03	29	1.3	13	8.8e+00	22	85	13
Methylnaphthalene, 2-				2.60e+04	29	2.90e-04	20	3.86	20	7.2e+02	calc	142	13
Naphthalene	8.2e-02	29	0.98	3.10e+04	SES	1.18e-03	SES	3.29	13	1.3e+03	SES	128	13
Nickel				-		-	-	-	-	-	-	59	13
Pentachlorophenol	1.1e-04	29		1.40e+04	29	2.80e-06	29	5.01	13	3.2e+04	13	266	13
Phenanthrene	9.6e-04	13	2.4e-03	8.16e+02	29	3.93e-05	29	4.45	13	1.4e+04	13	178	13
Phenol	0.35	29	8.75	8.00e+07	29	1.30e-06	29	1.46	13	9.1e+01	13	94	13
Polychlorinated biphenyls (PCBs)				5.90e+02	13	2.00e-03	13	6.5	13	5.3e+05	11	varies	
Pyrene	2.5e-06	13		1.60e+02	29	5.10e-06	29	4.88	13	3.8e+04	13	202	13
Selenium				-		-	-	-	-	-	-	79	13
Silver				-		-	-	-	-	-	-	108	13
Styrene	5	29	16.67	3.00e+05	29	2.61e-03	13	2.95	13	3.1e+00	calc	104	13

TABLE 3-1 CONTINUED

CHEMICALS	VAPOUR PRESSURE Torr @20-30C	REF	ODOUR INDEX	SOLUBILITY ug/L	REF	HENRY'S LAW CONSTANT atm-m3/mol	REF	LOG Kow	REF	Koc mg/L	REF	MOLECULAR WEIGHT g/mole	REF
Tetrachloroethane, 1,1,1,2-	10	29		2.90e+06	29	1.10e-02	29	-	-	5.4e+01	11	168	11
Tetrachloroethane, 1,1,2,2-	4	29	2.67	2.90e+06	29	3.80e-04	29	2.39	13	4.6e+01	13	168	13
Tetrachloroethylene	19	29	4.06	2.00e+05	SES	2.04e-03	SES	3.4	13	4.7e+02	SES	166	13
Thallium				-		-	-	-	-	-	-	204	13
Toluene	28	29	3.50	5.35e+05	SES	6.68e-03	SES	2.79	13	2.7e+02	SES	92	13
Total Petroleum Hydrocarbons				-				-	-			-	-
Trichlorobenzene, 1,2,4-				1.90e+04	29	1.42e-03	29	3.98	12	9.2e+03	11	181	11
Trichloroethane, 1,1,1-	100	29	0.83	7.30e+05	SES	2.31e-02	SES	2.49	13	1.6e+02	SES	133	13
Trichloroethane, 1,1,2-	25	29		4.50e+06	29	9.10e-04	13	2.42	13	3.1e+02	13	133	13
Trichloroethylene	77	29	0.01	1.10e+06	SES	9.12e-03	SES	2.42	13	1.2e+02	SES	131	13
Trichlorophenol, 2,4,5-				1.19e+06	29	2.18e-04	11	3.72	11	8.9e+01	11	197	11
Trichlorophenol 2,4,6-				8.00e+05	29	4.00e-06	29	3.69	13	2.0e+03	13	197	13
Vinyl chloride	2580	29	0.86	1.10e+03	29	2.78e-02	29	1.36	13	9.8e+01	13	63	13
Xylenes (Mixed Isomers)	6	29	60.00	1.71e+05	SES	5.27e-03	SES	3.33	13	3.0e+02	SES	106	13
Zinc				-		-	-	-	-	-	-	65	13

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MCP APPENDIX A

DERIVATION OF SOIL S-1

NORMALIZED AVERAGE DAILY SOIL INGESTION RATE (NADSIR)

NORMALIZED AVERAGE DAILY SOIL/SKIN CONTACT RATE (NADSCR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL INGESTION RATE (NLADSIR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL/SKIN CONTACT RATE (NLADSCR)

APPENDIX A

DERIVATION OF SOIL S-1 EXPOSURE RATES

1. SOIL INGESTION RATES:

This section describes the development of the soil ingestion rates used to calculate the S-1 soil standards. These values are age specific and normalized to body weight. As a result of the detailed analysis, each age group experiences a slightly different exposure, and the calculated annual average daily soil ingestion rates range between approximately 20 to 60 mg of soil per day. The step-wise process followed in the calculation of the exposure rates is described below.

STEP 1: Ingestion of indoor dust is considered for young children, aged 1 to 6 years. It is assumed that each exposure event consists of the ingestion of the dust/soil covering the surface of one half of one finger. Table A-1 develops soil ingestion rates for these indoor exposures, and this information is used in Step 2.

TABLE A-1

INDOOR-ONLY SOIL INGESTION EXPOSURE

AGE years	Skin Surface Area: 1/2 of One Finger[1] cm^2/event	Dust Adherence[2] mg/cm^2	Fraction of Dust from Soil[3]	Frequency of Finger Mouthing Events[4] events/hour	Hours of Exposure per day hrs/day	Soil Ingested - INDOOR ONLY[5] mg soil/day
1 < 2	7.3	0.056	0.8	9	3	28.8
2 < 3	7.7	0.056	0.8	9	7	21.7
3 < 4	9.9	0.056	0.8	9	7	27.9
4 < 5	10.1	0.056	0.8	9	7	28.5
5 < 6	11.1	0.056	0.8	9	7	31.3

1 - The surface area of 1/2 of one finger is assumed to be approximately equal to 1/40 the surface area of both hands. The source of the Surface area information is described in more detail in Table A-5. This value is derived from that table: (Column 2 * Column 3 /100/40).

2 - Hawley, 1985; average dust covering indoor surfaces assumed to be the average dust covering finger.

3 - Hawley, 1985

4 - MA DEQE, 1985

5 - The mass of soil ingested as a result of finger mouthing activities. Example, age 1 < 2:

$$7.3 * 0.056 * 0.8 * 9 * 3 = 8.8 \text{ mg soil/day}$$

STEP 2: An annual average daily soil intake is developed for each age group, as shown in Table A-2. This value is weighted to reflect the relative time spent outdoors where greater exposure to soil is expected. The resulting soil ingestion rates are then used in Step 3.

TABLE A-2

CALCULATION OF AGE-SPECIFIC SOIL INGESTION RATES

	SOIL INGESTION RATES * On days Exposed *		FREQUENCY OF EXPOSURE		ANNUAL AVERAGE 365 days
AGE years	Indoor Exposure Only[1] mg soil/d	Indoor & Outdoor Exposure[2] mg soil/d	Indoors Only[3] Oct. -> April of 212 days days	Indoors + Outdoors[4] May -> Sept. of 153 days days	DAILY SOIL INGESTION RATE[5] mg soil/d
< 1	0	0	0	0	0
1 < 2	8.8	100	212	44 + 109 = 153	47.0
2 < 3	21.7	100	212	44 + 109 = 153	54.5
3 < 4	27.9	100	212	44 + 109 = 153	58.1
4 < 5	28.5	100	212	44 + 109 = 153	58.5
5 < 6	31.3	100	212	44 + 109 = 153	60.1
6 < 7	0	50	0	44 + 109 = 153	21.0
7 < 8	0	50	0	44 + 109 = 153	21.0
8 < 9	0	50	0	44 + 109 = 153	21.0
9 < 10	0	50	0	44 + 109 = 153	21.0
10 < 11	0	50	0	44 + 109 = 153	21.0
11 < 12	0	50	0	44 + 109 = 153	21.0
12 < 13	0	50	0	44 + 109 = 153	21.0
13 < 14	0	50	0	44 + 109 = 153	21.0
14 < 15	0	50	0	44 + 109 = 153	21.0
15 < 16	0	50	0	44 + 109 = 153	21.0
16 < 17	0	50	0	44 + 109 = 153	21.0
17 < 18	0	50	0	44 + 109 = 153	21.0
18 < 25	0	50	0	44 + 109 = 153	21.0
25 < 30	0	50	0	44 + 109 = 153	21.0

1 - Indoor ONLY Exposures taken from Table A-1.

2 - Soil Ingestion Rate on days when BOTH Indoor & Outdoor exposures may occur taken from LaGoy (1987)

3 - 212 days is approximately 7 days/week from October through April. No outdoor exposure is assumed to occur during this period.

4 - 153 days approximates indoor exposures 2 days/week and outdoor exposures 5 days/week during this period.

5 - The average daily soil ingestion rate for this age group, adjusted for the frequency of exposure. Example, age 1 < 2 years:

[(8.8 mg/d * 212 d) + (100 mg/d * 153 d)]/365 d = 47.0 mgsoil/day

STEP 3: The soil ingestion rates from Step 2 are normalized to the body weight of each age group and weighted for the number of years in that age group (This is important for ages 18<25 and 25<30). This calculation is presented in Table A-3.

TABLE A-3

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL INGESTION EXPOSURES NORMALIZED TO BODYWEIGHT

AGE	MEDIAN BODY WEIGHT[1]	SOIL INGESTION RATE[2]	WEIGHTING FACTOR[3]	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD[4]
years	kg	mg soil/day	years	(mg * yrs)/(kg * d)
< 1	8.5	0	1	0
1 < 2	10.5	47.0	1	4.5
2 < 3	12.6	54.5	1	4.3
3 < 4	14.6	58.1	1	4
4 < 5	16.4	58.5	1	3.6
5 < 6	18.8	60.1	1	3.2
6 < 7	21.0	21.0	1	1
7 < 8	23.5	21.0	1	0.89
8 < 9	27.3	21.0	1	0.77
9 < 10	29.6	21.0	1	0.71
10 < 11	34.3	21.0	1	0.61
11 < 12	40.0	21.0	1	0.53
12 < 13	45.2	21.0	1	0.46
13 < 14	48.6	21.0	1	0.43
14 < 15	52.8	21.0	1	0.40
15 < 16	53.9	21.0	1	0.39
16 < 17	55.3	21.0	1	0.38
17 < 18	58.3	21.0	1	0.36
18 < 25	57.1	21.0	7	2.6
25 < 30	59.9	21.0	5	3.5

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43 & 5-45.
2 - Soil Ingestion Rate calculated in Table A-2.
3 - Weighting Factor is equal to the number of years represented by each age group.
4 - The Soil Ingestion Rate Normalized to Body Weight for the specified time period.

Example Calculation, age 1 < 2:

[(47.0 mg soil/d) * 1 yr]/10.5 kg = 4.5 (mg * yr)/(kg *d)

STEP 4: Finally, these age-specific values are combined to yield the time-weighted, normalized values used to calculate the risk-based concentration for Category S-1 soil. These values are developed in Table A-4, and the results summarized in Table 5-1.

TABLE A-4

CALCULATION OF THE NORMALIZED DAILY SOIL INTAKE RATES USED FOR S-1 STANDARD SETTING

NONCANCER EFFECTS

AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
1 < 2	4.5
2 < 3	4.3
3 < 4	4
4 < 5	3.6
5 < 6	3.2
6 < 7	1
7 < 8	0.89

# Years = 7	SUM: 21.5

Normalized Average Daily Soil Intake Rate:

21.5/7 = 3.1 mg soil/(kg*day)

CARCINOGENIC EFFECTS

AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
< 1	0
1 < 2	4.5
2 < 3	4.3
3 < 4	4
4 < 5	3.6
5 < 6	3.2
6 < 7	1
7 < 8	0.89
8 < 9	0.77
9 < 10	0.71
10 < 11	0.61
11 < 12	0.53
12 < 13	0.46
13 < 14	0.43
14 < 15	0.40
15 < 16	0.39
16 < 17	0.38
17 < 18	0.36
18 < 25	2.6
25 < 30	1.8

Exposure Period = 30 yr	SUM: 31

AVERAGING PERIOD
75 Years

Normalized Lifetime Average Daily Soil Intake Rate:

31/75 = 0.41 mg soil/(kg * day)

For the non-cancer risk-based concentration, the averaging period is equal to the exposure period. For cancer risk, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).

2. DERMAL CONTACT RATES

This section describes the development of the rates of contact between the soil and the receptor's skin. Absorption through the skin is potentially an important route of exposure which depends, in part, on the exposed skin surface area. Since surface area varies by age, the soil/dermal contact rate would be expected to vary by age as well. The values are age-specific and are normalized to body weight. The exposure model used to quantify the dermal contact exposure pathway assumes that some contact will occur in the home during winter months, but that the majority of the exposure will be received from indoor and outdoor exposures during the warmer time of the year. As a result of the detailed analysis, each age group experiences a slightly different exposure, and the calculated annual average daily contact rates range between approximately 10 to 1200 mg of soil per day. The step-wise process followed in the calculation of the exposure rates is summarized below and detailed in Tables A-5 through A-9.

STEP 1: For exposures which occur indoors, the amount of soil which comes into contact with the receptor's skin is calculated in Table A-5. This contact rate is for those days when exposure is thought to occur. The indoor exposure is quantified for ages 0 - 6. During the colder months only the hands are assumed to be regularly exposed to household dust, and infants are assumed not to be exposed. During the warmer months children are assumed to have a greater surface area exposed. The amount of soil in contact with the skin is dependent upon the surface area of the exposed body parts, the adherence of the dust to the skin, and the fraction of the household dust derived from soil sources.

TABLE A-5

INDOORS ONLY - DERMAL CONTACT

OCTOBER - APRIL

AGE years	Exposed Body Parts and % of Total Body Surface Area[1]	Total Body Surface Area[2] cm^2	Adherence Factor[3] mg/cm^2	Fraction of Dust Derived From Soil[4]	Soil In Contact With Skin On Days Exposed INDOORS ONLY[5] mg soil/day
< 1	none, -	4450[6]	0.056	0.8	-
1 < 2	hands, 5.68%	5130[6]	0.056	0.8	13.1
2 < 3	hands, 5.3%	5790	0.056	0.8	13.7
3 < 4	hands, 6.1%	6490	0.056	0.8	17.7
4 < 5	hands, 5.7%	7060	0.056	0.8	18.0
5 < 6	hands, 5.7%	7790	0.056	0.8	19.9
> 6	none, -	-	0.056	0.8	-

MAY - SEPTEMBER

AGE years	Exposed Body Parts and % of Total Body Surface Area	Total Body Surface Area[2] cm^2	Adherence Factor[3] mg/cm^2	Fraction of Dust Derived From Soil[4]	Soil In Contact With Skin On Days Exposed INDOORS ONLY[5] mg soil/day
< 1	Hands, Arms, Legs, Feet, 46%	4450	0.056	0.8	91.7
1 < 2	Hands, Arms, Legs, Feet, 48%	5130	0.056	0.8	110.3
2 < 3	Hands, Arms, Legs, Feet, 47%	5790	0.056	0.8	121.9
3 < 4	Hands, Arms, Legs, Feet, 54%	6490	0.056	0.8	157.0
4 < 5	Hands, Arms, Legs, Feet, 55%	7060	0.056	0.8	174.0
5 < 6	Hands, Arms, Legs, Feet, 52%[7]	7790	0.056	0.8	181.5
> 6	none, -	-	0.056	0.8	-

1 - Percentage of total body surface area by body part taken from U.S. EPA, 1989b, (mean values, p.4-12).

2 - 50th Percentile values for Total Body Surface Areas taken from U.S. EPA, 1989b (p. 4-31), except as noted below (6).

3 - Hawley, 1985

4 - Hawley, 1985

5 - The soil in contact with the skin (on days exposed) during this time period for the age group specified. Example calculation, age <1: **0.46 * 4450 * 0.056 * 0.8 = 91.7 mg soil**

6 - The total body surface area for ages <1 and 1<2 have been estimated using the equation $SA = K*BW^{2/3}$ (U.S. EPA, 1989b, p. 4-20), where SA = Surface Area, K is a constant (estimated from data available for ages 2<3) and BW is the receptor's body weight (Table 8-8).

7 - Data are unavailable for this age group. The Percentage of total body surface area used here is assumed to be equal to that for the 6 > 7 year old.

STEP 2: For the days when the receptor is exposed both indoors and outdoors, the amount soil in contact is calculated in Table A-6. This contact rate is for those days when exposure is thought to occur. Exposure to adults is quantified here as it is assumed that all ages have the opportunity for contact with the soil through play or gardening.

TABLE A-6

INDOORS & OUTDOORS - DERMAL CONTACT

MAY - SEPTEMBER

AGE years	Exposed Body Parts and % of Total Body Surface Area[1]	Total Body Surface Area[2] cm^2	Adherence Factor[3] mg/cm^2	Fraction Adhered Material Derived from Soil[4]	Soil In Contact With Skin On Days Exposed Both Indoors & Outdoors[5] mg soil/day
< 1	none, -	4450[6]	0.51	0.8	0
1 < 2	Hands, Arms, Legs, Feet, 48%	5130[6]	0.51	0.8	1005
2 < 3	Hands, Arms, Legs, Feet, 47%	5790	0.51	0.8	1110
3 < 4	Hands, Arms, Legs, Feet, 54%	6490	0.51	0.8	1430
4 < 5	Hands, Arms, Legs, Feet, 55%	7060	0.51	0.8	1584
5 < 6	Hands, Arms, Legs, Feet, 52%[7]	7790	0.51	0.8	1653
6 < 7	Hands, Arms, Legs, Feet, 52%	8430	0.51	0.8	1789
7 < 8	Hands, Arms, Legs, Feet, 54%[7]	9170	0.51	0.8	2020
8 < 9	Hands, Arms, Legs, Feet, 54%[7]	10000	0.51	0.8	2203
9 < 10	Hands, Arms, Legs, Feet, 54%	10600	0.51	0.8	2335
10 < 11	Hands, Arms, Legs, Feet, 57%[7]	11700	0.51	0.8	2721
11 < 12	Hands, Arms, Legs, Feet, 57%[7]	13000	0.51	0.8	3023
12 < 13	Hands, Arms, Legs, Feet, 57%	14000	0.51	0.8	3256
13 < 14	Hands, Arms, Legs, Feet, 57%	14800	0.51	0.8	3442
14 < 15	Hands, Arms, Legs, Feet, 59%[7]	15500	0.51	0.8	3731
15 < 16	Hands, Arms, Legs, Feet, 59%[7]	15700	0.51	0.8	3779
16 < 17	Hands, Arms, Legs, Feet, 59%	16000	0.51	0.8	3852
17 < 18	Hands, Arms, Legs, Feet, 61%	16300	0.51	0.8	4057
18 < 30	Hands, Forearms, Lower legs, Feet, 30%	16900	0.51	0.8	2069

1 - Mean values for Percentage of total body surface area by body part taken from U.S. EPA, 1989b (pp. 4-11 & 4-12), except as noted below (7).

2 - 50th Percentile Total Body Surface Areas taken from U.S. EPA, 1989b (pp. 4-29 & 4-31), except as noted below (6).

3 - Hawley, 1985

4 - Hawley, 1985

5 - The soil in contact with the skin (on days exposed) during this time period for the age group specified. Example calculation, age 1 < 2: **0.48 * 5130 * 0.51 * 0.8 = 1005 mg soil/day**

6 - The total body surface area for ages <1 and 1<2 have been estimated using the equation $SA = K*BW^{2/3}$ (U.S. EPA, 1989b, p. 4-20), where SA = Surface Area, K is a constant (estimated from data available for ages 2<3) and BW is the receptor's body weight (Table A-7).

7 - Data are unavailable for this age group. The Percentage of total body surface area used here is taken from the next oldest age group for which data is available (i.e., the % for the 6<7 yr old is used for the 5<6 age group).

STEP 3: The indoor and outdoor soil contact rates (the results of Tables A-5 and A-6, respectively) are then combined with exposure frequency assumptions to yield an average daily soil contact rate for the year. These rates are presented in Table A-7, and range between 10 to 1200 mg soil per day, depending upon the age of the receptor.

TABLE A-7

CALCULATION OF AGE-SPECIFIC SOIL DERMAL CONTACT RATES

	SOIL DERMAL CONTACT RATES ** On days exposed **			FREQUENCY OF EXPOSURE			ANNUAL AVERAGE 365 d
AGE years	Indoor Only Oct -> April[1] mg soil/d	Indoor Only May -> Sept.[2] mg soil/d	Indoor & Outdoor May -> Sept.[3] mg soil/d	Indoor Only Oct -> April[4] of 212 days days	Indoor Only May -> Sept.[5] of 153 days days	Indoor & Outdoor May -> Sept.[6] of 153 days days	DAILY SOIL DERMAL CONTACT RATE[7] mg soil/d
< 1	0	91.7	0	0	44	0	11.1
1 < 2	13.1	110.3	1005	212	44	109	321
2 < 3	13.7	121.9	1110	212	44	109	354
3 < 4	17.7	157.0	1430	212	44	109	456
4 < 5	18.0	174.0	1584	212	44	109	504
5 < 6	19.9	181.5	1653	212	44	109	527
6 < 7	0	0	1789	0	0	109	534
7 < 8	0	0	2020	0	0	109	603
8 < 9	0	0	2203	0	0	109	658
9 < 10	0	0	2335	0	0	109	697
10 < 11	0	0	2721	0	0	109	813
11 < 12	0	0	3023	0	0	109	903
12 < 13	0	0	3256	0	0	109	972
13 < 14	0	0	3442	0	0	109	1028
14 < 15	0	0	3731	0	0	109	1114
15 < 16	0	0	3779	0	0	109	1129
16 < 17	0	0	3852	0	0	109	1150
17 < 18	0	0	4057	0	0	109	1212
18 < 30	0	0	2069	0	0	109	618

1 - Indoor Only Contact Rates for Oct. through April taken from Table A-5.
2 - Indoor Only Contact Rates for May through Sept. taken from Table A-5.
3 - Contact Rates on days when both indoor and outdoor exposure is thought to occur taken from Table A-6.
4 - 212 days is approximately 7 days/week from October through April.
5 - 44 days is approximately 2 days/week from May through September.
6 - 109 days is approximately 5 days/week from May through September.
7 - The average daily exposure to soil in dermal contact with the skin for this age group, adjusted for the frequency of exposure.
Example calculation, age 2<3 years:

$$((13.7 * 212) + (121.9 * 44) + (1110 * 109))/365 = 354 \text{ mg soil/day}$$

STEP 4: The annual average contact rates derived in Table A-7 are then normalized to the body weight of each age group and weighted by the number of years in that age group. This calculation is presented in Table A-8.

TABLE A-8

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL DERMAL CONTACT EXPOSURES NORMALIZED TO BODYWEIGHT

AGE years	MEDIAN BODY WEIGHT[1] kilograms	SOIL DERMAL CONTACT RATE[2] mg soil/day	WEIGHTING FACTOR[3] years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD[4] (mg * yrs)/(kg * d)
< 1	8.5	11.1	1	1.3
1 < 2	10.5	321	1	30.6
2 < 3	12.6	354	1	28.1
3 < 4	14.6	456	1	31.2
4 < 5	16.4	504	1	30.7
5 < 6	18.8	527	1	28.0
6 < 7	21.0	534	1	25.4
7 < 8	23.5	603	1	25.7
8 < 9	27.3	658	1	24.1
9 < 10	29.6	697	1	23.5
10 < 11	34.3	813	1	23.7
11 < 12	40.0	903	1	22.6
12 < 13	45.2	972	1	21.5
13 < 14	48.6	1028	1	21.2
14 < 15	52.8	1114	1	21.1
15 < 16	53.9	1129	1	20.9
16 < 17	55.3	1150	1	20.8
17 < 18	58.3	1212	1	20.8
18 < 25	57.1	618	7	75.8
25 < 30	59.9	618	5	51.6

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43 & 5-45.
2 - Soil Dermal Contact calculated in Table A-7.
3 - Weighting Factor is equal to the number of years represented by each age group.
4 - The Soil Dermal Contact Rate Normalized to Body Weight for the specified time period.
Example Calculation, age 1 < 2:

[(321 mg soil/d) * 1 yr]/10.5 kg = 30.6 (mg * yr)/(kg * d)

STEP 5: Finally, these age-specific values are combined to yield the time-weighted, normalized exposure rates used to calculate the risk-based concentrations. These values are developed in Table A-9 and the results summarized in Table 5-1.

TABLE A-9

CALCULATION OF THE NORMALIZED DAILY SOIL DERMAL CONTACT RATES USED FOR S - 1 STANDARD SETTING

NONCANCER RISK

AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
1 < 2	30.6
2 < 3	28.1
3 < 4	31.2
4 < 5	30.7
5 < 6	28.0
6 < 7	25.4
7 < 8	25.7

# Years = 7	SUM: 199.7

Normalized Average Daily Soil Dermal Contact Rate:

199.7/7 = 28.5 mg soil/(kg*day)

CANCER RISK

AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
< 1	1.3
1 < 2	30.6
2 < 3	28.1
3 < 4	31.2
4 < 5	30.7
5 < 6	28.0
6 < 7	25.4
7 < 8	25.7
8 < 9	24.1
9 < 10	23.5
10 < 11	23.7
11 < 12	22.6
12 < 13	21.5
13 < 14	21.2
14 < 15	21.1
15 < 16	20.9
16 < 17	20.8
17 < 18	20.8
18 < 25	75.8
25 < 30	51.6

Exposure Period = 30 yr	SUM: 548.6

AVERAGING PERIOD
75 Years

Normalized Lifetime Average Daily Soil Dermal Contact Rate:

548.6/75 = 7.3 mg soil/(kg * day)

For the evaluation of non-cancer risk-base concentrations, the averaging period is equal to the exposure period. For cancer risk-based concentrations, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).

MCP APPENDIX B

DERIVATION OF SOIL S-2

NORMALIZED AVERAGE DAILY SOIL INGESTION RATE (NADSIR)

NORMALIZED AVERAGE DAILY SOIL/SKIN CONTACT RATE (NADSCR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL INGESTION RATE (NLADSIR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL/SKIN CONTACT RATE (NLADSCR)

APPENDIX B

DERIVATION OF SOIL S-2 EXPOSURE RATES

1. SOIL INGESTION RATES:

This section describes the development of the soil ingestion rates used to calculate the S-2 soil standards. These values are age specific and normalized to body weight. The step-wise process followed in the calculation of the exposure rates is summarized below.

STEP 1: An annual average daily soil intake was developed for each age group, as shown in Table B-1. This value is weighted to reflect the relative time spent outdoors where greater exposure to soil would be expected. The resulting soil ingestion rates are then used in Step 2.

TABLE B-1

SOIL S-2
CALCULATION OF AGE-SPECIFIC SOIL INGESTION RATES

	RATE OF EXPOSURE	FREQUENCY OF EXPOSURE		ANNUAL AVERAGE 365 days
AGE years	Outdoor Exposure Rate[1] mg soil/d	Winter [2] Nov. -> March of 151 days days	Outdoors[3] April -> Oct. of 214 days days	DAILY SOIL INGESTION RATE[4] mg soil/d
18 < 25	50	0	129	17.7
25 < 35	50	0	129	17.7
35 < 45	50	0	129	17.7

1 - Soil Ingestion Rate on days when outdoor exposures may occur taken from LaGoy (1987)
2 - No outdoor exposure to soil is assumed to occur during this period.
3 - 129 days approximates outdoor exposures 5 days/week, less approximately 24 days when exposure doesn't occur due to weather, vacations, etc...
4 - The average daily soil ingestion rate for this age group, adjusted for the frequency of exposure. Example, age 18 < 25 years:

$$(50 \text{ mg/d} * 129 \text{ d})/365 \text{ days} = 17.7 \text{ mg soil/day}$$

STEP 2: The soil ingestion rates from Step 1 are normalized to the body weight of each age group and weighted for the number of years in that age group. This calculation is presented in Table B-2.

TABLE B-2

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL INGESTION EXPOSURES NORMALIZED TO BODYWEIGHT

AGE years	MEDIAN BODY WEIGHT[1] kilograms	SOIL INGESTION RATE[2] mg soil/day	WEIGHTING FACTOR[3] years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD[4] (mg * yrs)/(kg * d)
18 < 25	57.1	17.7	7	2.17
25 < 35	59.9	17.7	10	2.95
35 < 45	62.4	17.7	10	2.84

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43 & 5-45.
2 - Soil Ingestion Rate calculated in Table B-1.
3 - Weighting Factor is equal to the number of years represented by each age group.
4 - The Soil Ingestion Rate Normalized to Body Weight for the specified time period. Example Calculation, age 18 < 25:

$$[(17.7 \text{ mg soil/d}) * 7 \text{ yr}]/57.1 \text{ kg} = 2.17 \text{ (mg * yr)/(kg * d)}$$

STEP 3: Finally, these age-specific values are combined to yield the time-weighted, normalized values used to calculate the risk-based concentration for Category S-2 soil. These values are developed in Table B-3, and the results summarized in Table 5-3.

TABLE B-3

CALCULATION OF THE NORMALIZED DAILY SOIL INTAKE RATES USED TO CALCULATE S-2 SOIL STANDARDS

NONCANCER EFFECTS		CARCINOGENIC EFFECTS	
AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)	AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
18 < 25	2.17	18 < 25	2.17
25 < 35	2.95	25 < 35	2.95
35 < 45	2.84	35 < 45	2.84
# Years = 27	SUM: 7.96	Exposure Period = 27 yr	SUM: 7.96
Normalized Average Daily Soil Intake Rate: **7.96/27 = 0.29 mg soil/(kg*day)**		AVERAGING PERIOD 75 Years	
For the calculation of non-cancer risk-based concentrations, the averaging period is equal to the exposure period. For cancer risk-based concentrations, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).		**Normalized Lifetime Average Daily Soil Intake Rate:** **7.96/75 = 0.11 mg soil/(kg * day)**	

2. DERMAL CONTACT RATES

This section will describe the development of the rates of contact between the soil and the receptor's skin. Absorption through the skin is potentially an important route of exposure which depends, in part, on the exposed skin surface area. Since surface area varies by age, the soil/dermal contact rate would be expected to vary by age as well. The values are age-specific and are normalized to body weight. As a result of the detailed analysis, each age group experiences a slightly different exposure. The step-wise process followed in the calculation of the exposure rates is summarized below and detailed in Tables B-4 through B-7.

STEP 1: For outdoor exposures, the amount of soil which comes into contact with the receptor's skin is calculated in Table B-4. This contact rate is for those days when exposure is thought to occur. The amount of soil in contact with the skin is dependent upon the surface area of the exposed body parts and the adherence of the soil to the skin.

TABLE B-4

OUTDOORS - DERMAL CONTACT

APRIL - OCTOBER

AGE years	Exposed Body Parts and % of Total Body Surface Area[1]	Total Body Surface Area[2] cm^2	Adherence Factor[3] mg/cm^2	Soil In Contact With Skin On Days Exposed Outdoors[4] mg soil/day
18 < 25	Hands, Forearms, Lower legs, Feet,	16900	0.51	2586
25 < 35	30%	16900	0.51	2586
35 < 45	Hands, Forearms, Lower legs, Feet,	16900	0.51	2586
	30%			
	Hands, Forearms, Lower legs, Feet,			
	30%			

1 - Mean values for Percentage of total body surface area by body part taken from U.S. EPA, 1989b (pp. 4-11).
2 - 50th Percentile Total Body Surface Areas taken from U.S. EPA, 1989b (pp. 4-29).
3 - Hawley, 1985
4 - The soil in contact with the skin (on days exposed) during this time period for the age group specified. Example calculation,
age 25 < 35:

0.30 * 16900 * 0.51 = 2586 mg soil/day

STEP 2: The outdoor soil contact rates (Table B-4) are then combined with exposure frequency assumptions to yield an average daily soil contact rate for the year. These rates are presented in Table B-5.

TABLE B-5

CALCULATION OF AGE-SPECIFIC SOIL DERMAL CONTACT RATES

	SOIL DERMAL CONTACT RATES ** On days exposed **		FREQUENCY OF EXPOSURE		ANNUAL AVERAGE 365 days
AGE years	Winter Nov -> March[1] mg soil/day	Outdoor April -> Oct.[3] mg soil/day	Winter Nov -> March[4] of 151 days days	Outdoor April -> Oct.[6] of 214 days days	DAILY SOIL DERMAL CONTACT RATE[7] mg soil/d
18 < 25	0	2586	0	129	914
25 < 35	0	2586	0	129	914
35 < 45	0	2586	0	129	914

1 - No exposure to soil is thought to occur during this time.
2 - Contact Rates on days when outdoor exposure is thought to occur taken from Table B-4.
3 - 129 days approximates outdoor exposures 5 days/week, less approximately 24 days when exposure doesn't occur due to weather, vacations, etc...
4 - The average daily exposure to soil in dermal contact with the skin for this age group, adjusted for the frequency of exposure. Example calculation, age 25 < 35 years:

(2586 * 129)/365 = 914 mg soil/day

STEP 3: The annual average contact rates derived in Table B-5 are then normalized to the body weight of each age group and weighted by the number of years in that age group. This calculation is presented in Table B-6.

TABLE B-6

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL DERMAL CONTACT EXPOSURES NORMALIZED TO BODYWEIGHT

AGE years	MEDIAN BODY WEIGHT[1] kilograms	SOIL DERMAL CONTACT RATE[2] mg soil/day	WEIGHTING FACTOR[3] years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD[4] (mg * yrs)/(kg * d)
18 < 25	57.1	914	7	112.0
25 < 35	59.9	914	10	152.6
35 < 45	62.4	914	10	146.5

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43.
2 - Soil Dermal Contact calculated in Table B-5.
3 - Weighting Factor is equal to the number of years represented by each age group.
4 - The Soil Dermal Contact Rate Normalized to Body Weight for the specified time period.
Example Calculation, age 35 < 45:

$$[(914 \text{ mg soil/d}) * 10 \text{ yr}]/62.4 \text{ kg} = 146.5 \text{ (mg * yr)/(kg * d)}$$

STEP 4: Finally, these age-specific values are combined to yield the time-weighted, normalized exposure rates used to calculate the risk-based concentrations. These values are developed in Table B-7 and the results summarized in Table 5-1.

TABLE B-7

CALCULATION OF THE NORMALIZED DAILY SOIL DERMAL CONTACT RATES USED TO CALCULATE S-2 STANDARDS

NONCANCER EFFECTS		CARCINOGENIC EFFECTS	
AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)	AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
18 < 25	112.0	18 < 25	112.0
25 < 35	152.6	25 < 35	152.6
35 < 45	146.5	35 < 45	146.5
# Years = 27	SUM: 411.1	Exposure Period = 27 yr	SUM: 411.1
		AVERAGING PERIOD 75 Years	

Normalized Average Daily Soil Dermal Contact Rate:

411.1/27 = 15.2 mg soil/(kg*day)

For the non-cancer risk concentration, the averaging period is equal to the exposure period. For cancer risk, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).

Normalized Lifetime Average Daily Soil Dermal Contact Rate:

411.1/75 = 5.48 mg soil/(kg * day)

MCP APPENDIX C

DERIVATION OF SOIL S-3

NORMALIZED AVERAGE DAILY SOIL INGESTION RATE (NADSIR)

NORMALIZED AVERAGE DAILY SOIL/SKIN CONTACT RATE (NADSCR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL INGESTION RATE (NLADSIR)

NORMALIZED LIFETIME AVERAGE DAILY SOIL/SKIN CONTACT RATE (NLADSCR)

APPENDIX C

DERIVATION OF SOIL S-3
EXPOSURE RATES

1. SOIL INGESTION RATES:

This section describes the development of the soil ingestion rates used to calculate the S-3 soil standards. These values are age specific and normalized to body weight. The step-wise process followed in the calculation of the exposure rates is summarized below.

STEP 1: An annual average daily soil intake was developed for each age group, as shown in Table C-1. This value is weighted to reflect the relative time spent outdoors where greater exposure to soil would be expected. The resulting soil ingestion rates are then used in Step 2.

TABLE C-1

SOIL S-3
CALCULATION OF AGE-SPECIFIC SOIL INGESTION RATES

	RATE OF EXPOSURE	FREQUENCY OF EXPOSURE			
AGE years	Outdoor Exposure Rate[1] mg soil/d	June, July, August[2] of 92 days days	April, May, Sept, Oct.[3] of 122 days days	Averaging Period[4] days	DAILY SOIL INGESTION RATE[5] mg soil/d
18 < 25	50	56	73	365	17.7
22	50	66	0	92	35.9

1 - Soil Ingestion Rate on days when outdoor exposures may occur taken from LaGoy (1987)
2 - 56 days approximates 5 days/week less 10 days when exposure doesn't occur due to weather, vacations, etc... 66 days assumes 5 days/week.
3 - 73 days approximates outdoor exposures 5 days/week, less approximately 15 days when exposure doesn't occur due to weather, vacations, etc...
4 - The seven year exposure is expressed as an annual (365 day) average, but the 3 month exposure is averaged over the exposure period.
5 - The average daily soil ingestion rate for this age group, adjusted for the frequency of exposure. Example, age 18 < 25 years:

((50 mg/d * 56 d) + (50 mg/d * 73 d))/365 days = 17.7 mg soil/day

STEP 2: The soil ingestion rates from Step 1 are normalized to the body weight of each age group and weighted for the number of years in that age group. This calculation is presented in Table C-2.

TABLE C-2

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL INGESTION EXPOSURES NORMALIZED TO BODYWEIGHT

AGE years	MEDIAN BODY WEIGHT[1] kilograms	SOIL INGESTION RATE[2] mg soil/day	WEIGHTING FACTOR[3]	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD[4]
18 < 25	57.1	17.7	7	2.17 (mg*yrs)/(kg*d)
22	57.1	35.9	92	57.8 (mg*d)/(kg*d)

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43.

2 - Soil Ingestion Rate calculated in Table C-1.

3 - Weighting Factor is equal to the number of years or days represented by each age group.

4 - The Soil Ingestion Rate Normalized to Body Weight for the specified time period. Example Calculation, age 18 < 25:

$$[(17.7 \text{ mg soil/d}) * 7 \text{ yr}]/57.1 \text{ kg} = 2.17 \text{ (mg * yr)/(kg * d)}$$

STEP 3: Finally, these age-specific values are combined to yield the time-weighted, normalized values used to calculate the risk-based concentration for Category S-3 soil. These values are developed in Table C-3, and the results summarized in Table 5-1.

TABLE C-3

CALCULATION OF THE NORMALIZED DAILY SOIL INTAKE RATES USED TO CALCULATE S-3 SOIL STANDARDS

NONCANCER EFFECTS		CARCINOGENIC EFFECTS	
AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)	AGE years	DAILY SOIL INGESTION RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
22	57.8	18 < 25	2.17
# days = 92	-------- SUM: 57.8	Exposure Period = 7 yr	-------- SUM: 2.17
Normalized Average Daily Soil Intake Rate: **57.8/92 = 0.63 mg soil/(kg*day)**		AVERAGING PERIOD 75 Years	
For the calculation of non-cancer risk-based concentrations, the averaging period is equal to the exposure period. For cancer risk-based concentrations, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).		**Normalized Lifetime Average Daily Soil Intake Rate:** **2.17/75 = 0.029 mg soil/(kg * day)**	

2. DERMAL CONTACT RATES

This section describes the development of the rates of contact between the soil and the receptor's skin. Absorption through the skin is potentially an important route of exposure which depends, in part, on the exposed skin surface area. Since surface area varies by age, the soil/dermal contact rate would be expected to vary by age as well. The values are age-specific and normalized to body weight. As a result of the detailed analysis, each age group experiences a slightly different exposure. The step-wise process followed in the calculation of the exposure rates is summarized below and detailed in Tables C-4 through C-7.

STEP 1: For outdoor exposures, the amount of soil which comes into contact with the receptor's skin is calculated in Table C-4. This contact rate is for those days when exposure is thought to occur. The amount of soil in contact with the skin is dependent upon the surface area of the exposed body parts and the adherence of the soil to the skin.

TABLE C-4

OUTDOORS - DERMAL CONTACT

APRIL - OCTOBER

AGE years	Exposed Body Parts and % of Total Body Surface Area[1]	Total Body Surface Area[2] cm^2	Adherence Factor[3] mg/cm^2	Soil In Contact With Skin On Days Exposed Outdoors[5] mg soil/day
18 < 25	Hands, Forearms, Lower legs, Feet, 30%	16900	0.51	2586
22	Hands, Forearms, Lower legs, Feet, 30%	16900	0.51	2586

1 - Mean values for Percentage of total body surface area by body part taken from U.S. EPA, 1989b (pp. 4-11).
2 - 50th Percentile Total Body Surface Areas taken from U.S. EPA, 1989b (pp. 4-29).
3 - Hawley, 1985
4 - The soil in contact with the skin (on days exposed) during this time period for the age group specified. Example calculation, age 18 < 25:

$$0.30 * 16900 * 0.51 = 2586 \text{ mg soil/day}$$

STEP 2: The outdoor soil contact rates (Table C-4) are then combined with exposure frequency assumptions to yield an average daily soil contact rate for the year. These rates are presented in Table C-5.

TABLE C-5

CALCULATION OF AGE-SPECIFIC SOIL DERMAL CONTACT RATES

	SOIL DERMAL CONTACT RATES ** On days exposed **		FREQUENCY OF EXPOSURE			
AGE	June, July, August[1]	April, May, Sept, Oct.[1]	June, July August[2] of 92 days	April, May, Sept, Oct.[3] of 122 days	Averaging Period[4]	DAILY SOIL DERMAL CONTACT RATE[5]
years	mg soil/day	mg soil/day	days	days		mg soil/d
18 < 25	2586	2586	56	73	365 days	914
22	2586	2586	66	0	92 days	1855

1 - Contact Rates on days when outdoor exposure is thought to occur taken from Table C-4.

2 - 56 days approximates 5 days/week less 10 days when exposure doesn't occur due to weather, vacations, etc... 66 days assumes 5 days/week.

3 - 73 days approximates outdoor exposures 5 days/week, less approximately 15 days when exposure doesn't occur due to weather, vacations, etc...

4 - The seven year exposure is expressed as an annual (365 day) average, but the 3 month exposure is averaged over the exposure period.

5 - The average daily exposure to soil in dermal contact with the skin for this age group, adjusted for the frequency of exposure. Example calculation, age 18 < 25 years:

$$((2586 * 56) + (2586 * 73))/365 = 914 \text{ mg soil/day}$$

STEP 3: The annual average contact rates derived in Table C-5 are then normalized to the body weight of each age group and weighted by the number of years in that age group. This calculation is presented in Table C-6.

TABLE C-6

CALCULATION OF TIME-WEIGHTED AVERAGE DAILY SOIL DERMAL CONTACT EXPOSURES NORMALIZED TO BODYWEIGHT

AGE years	MEDIAN BODY WEIGHT[1] kilograms	SOIL DERMAL CONTACT RATE[2] mg soil/day	WEIGHTING FACTOR[3] years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD[4]
18 < 25	57.1	914	7	112.0 (mg * yrs)/(kg * d)
22	57.1	1855	92	2988.8 (mg * d)/(kg * d)

1 - 50th percentile body weights taken from U.S. EPA, 1989b, pp. 5-43.
2 - Soil Dermal Contact calculated in Table C-5.
3 - Weighting Factor is equal to the time (years & days, respectively) represented by each age group.
4 - The Soil Dermal Contact Rate Normalized to Body Weight for the specified time period. Example Calculation, age 18 < 25: **[(914 mg soil/d) * 7 yr]/57.1 kg = 112.0 (mg * yr)/(kg * d)**

STEP 4: Finally, these age-specific values are combined to yield the time-weighted, normalized exposure rates used to calculate the risk-based concentrations. These values are developed in Table C-7 and the results summarized in Table 5-1.

TABLE C-7

CALCULATION OF THE NORMALIZED DAILY SOIL DERMAL CONTACT RATES USED TO CALCULATE S-3 STANDARDS

NONCANCER EFFECTS		CARCINOGENIC EFFECTS	
AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)	AGE years	DAILY SOIL DERMAL CONTACT RATE FOR THE TIME PERIOD (mg * yrs)/(kg * d)
22	2988.8	18 < 25	112.0
	--------	Exposure Period = 7 yr	SUM: 112.0
# days = 92	SUM: 2988.8	AVERAGING PERIOD 75 Years	
Normalized Average Daily Soil Dermal Contact Rate: **2988.8/92 = 32.5 mg soil/(kg*day)**		**Normalized Lifetime Average Daily Soil Dermal Contact Rate:** **112.0/75 = 1.5 mg soil/(kg * day)**	
For the evaluation of non-cancer risk, the averaging period is equal to the exposure period. For cancer risk, the averaging period is a lifetime (75 years), independent of the length of the exposure period (MA DEQE, 1989a).			

MCP APPENDIX F

DEVELOPMENT OF DILUTION/ATTENUATION FACTORS (DAFs) FOR THE LEACHING-BASED SOIL STANDARDS

DEVELOPMENT OF DILUTION/ATTENUATION FACTORS (DAFs) FOR THE LEACHING-BASED SOIL STANDARDS

INTRODUCTION

The Massachusetts Department of Environmental Protection has developed dilution attenuation factors (DAFs) in order to establish soil cleanup criteria for the protection of groundwater from leaching of residual contaminants in soil. DEP has adopted the modeling approach utilized by the State of Oregon in a similar process. This report describes the model and its application toward the development of DAFs for Massachusetts for a limited number of compounds of concern, and the subsequent development of one regression algorithm that relates DAFs developed by Oregon to those applicable in Massachusetts, and another algorithm that relates DAFs to chemical specific parameters. The pathway to groundwater is only one consideration in the final determination of an acceptable soil cleanup level.

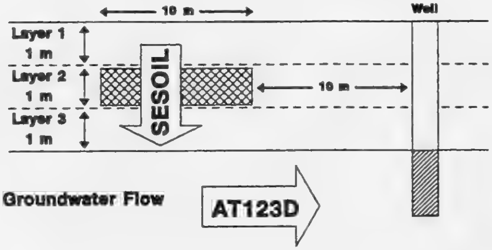
THE OREGON MODEL

The Oregon model (Anderson, 1992) assumes a generic setting for a release of contaminant in the unsaturated zone and then applies the combination of SESOIL and AT123D models to estimate impact of the initial soil loading on a receptor assumed directly downgradient of the site via the groundwater pathway. The SESOIL and AT123D models, while previously individually developed (see References, Bonazountas, 1984 and Yeh, 1981), are a part of the risk assessment Graphical Exposure Modeling System (GEMS) developed by USEPA. A pc-based version of this (PCGEMS) was developed for USEPA by General Sciences Corporation (1989). The two models can now be linked so that SESOIL can pass leachate loadings to the saturated zone AT123D model.

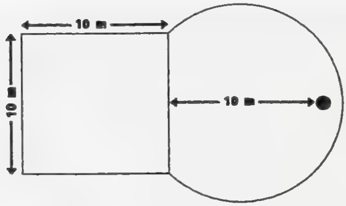
The Oregon model's site setting (see Figure 1) assumes a 3-meter thick unsaturated zone, divided into three 1-meter layers. Contamination is initially released in the middle layer, as might occur for a leaking tank or for a residual contaminant remaining after some remedial excavation with clean cover backfill, and is uniformly distributed in this layer over a 10 meter by 10 meter area. The unsaturated zone and aquifer are assumed to be the same sandy soil with uniform properties. The upper and lower unsaturated zone layers are initially clean, as is the aquifer.

FIGURE 1
CONCEPTUAL SETTING

VERTICAL CROSS-SECTION



HORIZONTAL CROSS-SECTION



Source: Anderson (1991)

SESOIL inputs include the soil type parameters, chemical properties, application rates, and the climatic conditions of the area. The model is run as a transient monthly estimator of leachate volumes and concentrations. Initially, no other transport mechanisms other than leaching, partitioning, and volatilization were considered. Oregon used default values in SESOIL for Portland Oregon climatic conditions, but distributed total precipitation uniformly over the year.

SESOIL was initially found to overestimate losses via volatilization. A parameter, the volatilization fraction (VOLF), was introduced to allow adjustment of losses through this pathway and allow a site-specific calibration. This factor may be varied in time and space. The Oregon study used a uniform VOLF factor of 0.2, based on consultation with a panel of experts. One other soil-related parameter is the disconnectedness index. This parameter varies for and within soil types. Two values are given as SESOIL defaults, and the larger, 7.5, has been used in the simulations. An increase in this parameter appears to result in a higher soil moisture, lower leachate rates, and somewhat lower DAFs (i.e., is more conservative) for the compounds run.

AT123D inputs include general aquifer properties, source configuration, loadings to groundwater, soil partition coefficients, and dispersivity values. The aquifer is assumed to be infinitely wide and thick. The pc-based version of AT123D accepts monthly transient loading rates calculated by SESOIL, and also provides a preprocessor for input file preparation and editing. In utilizing the model, the center of the 10 by 10 meter source area is assumed to be at coordinates 0,0,0. The positive x-axis is in the direction of flow. Calculated concentrations are maximum along the x-axis ($y=0$) and at the water table surface ($z=0$). Since the receptor is assumed to be 10 meters from the downgradient edge of the source area, the concentration at $x=15$, $y=0$, and $z=0$ represents the receptor location. Oregon used longitudinal, transverse, and vertical dispersivities of 20m, 2m, and 2m, respectively. These values seem high for a sandy aquifer, but the values have been retained to be consistent with the Oregon base values and to be protective of the Commonwealth's sensitive aquifers on Cape Cod. DAFs are proportional to the dispersivities, particularly sensitive to the vertical dispersivity.

Oregon ran the model for 10 indicator compounds and then developed a multiple linear regression model relating the DAF to the organic partition coefficient (K_{oc}) and the Henry's Law constant (H) to provide preliminary DAFs for sixty other organic compounds. Soil cleanup levels were generated based on the regression algorithm and a safe drinking water level for each compound. In some cases, risk based levels determined by other pathways were lower than the levels required to protect groundwater. In these instances, the lower value was selected as the soil target level. A similar approach was taken to develop the MCP Method 1 Standards, as described in Section 5.3.

SIMULATIONS FOR MASSACHUSETTS

The approach taken to develop DAFs for Massachusetts was to determine the effect that varying the location (changing the climatic conditions from Portland, Oregon to Boston, Massachusetts in SESOIL) would have on the Oregon calculated DAFs. If the model system was essentially linear with respect to loading, then DAFs already calculated for Oregon would be directly related to DAFs appropriate for Massachusetts, and the general algorithm developed by Oregon (with coefficients adjusted) could also be used to estimated DAFs for other compounds. To this end, model runs were made using the Oregon input values for SESOIL and AT123D with the exception of climate parameter values. Eight indicator compounds were selected: benzene, toluene, ethylbenzene, o-xylene, trichloroethene, tetrachloroethene, 1,1,1-trichloroethane, and naphthalene.

The input values for SESOIL are shown in Tables F-1 through F-4, and those for AT123D are shown on Table F-5. Depending on the mobility of the compound through the transport pathway, model runs varied from 2 years to 6 years as necessary to determine the maximum concentration attained at the receptor location for a specific compound. A point to consider in the adoption of the Oregon values, or adjustments to them, is the need to agree with the physio-chemical parameters that were used to generate the DAFs. Even in the eight indicator compounds selected, various accepted databases provide some widely varying values for S, H and K_{oc}. For example, for PCE, H is reported with an order of magnitude difference, and values of K_{oc} and solubility differing by a factor of 2 are reported for ethylbenzene in the literature.

Output concentrations at the selected receptor location demonstrated a cyclical nature due to seasonal variations in precipitation and net recharge. Maximum concentrations were not always attained in the first cycle due to seasonal variability. However, the model output appeared to be linear with respect to the initial loading, allowing soil cleanup levels to be estimated based on the linear DAF approach. Table F-6 shows the model-based DAFs for Oregon and Massachusetts, and also, based on listed safe drinking water levels and the estimated DAFs for Massachusetts, what soil target levels would be for the eight indicator compounds run.

TABLE F-1
CLIMATE PARAMETER VALUES FOR THE SESOIL MODEL

Default climate values for Boston as contained in the SESOIL model. Latitude = 42 degrees.

TABLE F-2

SOIL PARAMETER VALUES FOR THE SESOIL MODEL

Intrinsic permeability = 1x10^{-7} cm^2
Source area = 1,000,000 cm^2
Porosity = 0.3
Disconnectedness index = 7.5
Soil bulk density = 1.5 gm/cm^3
Soil organic carbon = 0.1%

Layer 1 thickness = 100 cm
Layer 2 thickness = 100 cm
Layer 3 thickness = 100 cm
No further sublayering specified

Clay content = 0%

All other parameters set to zero except those to indicate uniform parameters in all layers.

TABLE F-3
APPLICATIONS DATA
FOR SESOIL MODEL

Application month = October only
layer = 2
rate = 1500 microgm/cm^2
year = 1 only

Based on the area, thickness and bulk density, this produces an initial concentration of 10 ppm. No other sources are added.

Volatile fraction
(VOLF) = 0.2

Uniform in time and space.

All other parameter values set to zero.

TABLE F-4
CHEMICAL DATA FOR SESOIL MODEL

Compound	MW ml/g	K_{oc} mg/L	S atm-m^3/mol	H cm^2/sec	DA
benzene	78	83	1780	0.0055	0.109
ethylbenzene	106	575	161	0.00343	0.093
toluene	92	270	535	0.00668	0.100
o-xylene	106	302	171	0.00527	0.093
TCE	131	124	1100	0.00912	0.083
PCE	166	468	200	0.00204	0.075
1,1,1-TCA	133	157	730	0.0231	0.080
naphthalene	128	1288	31	0.00118	0.085

MW = molecular weight
K_{oc} = organic carbon partition coefficient
S = solubility in water
H = Henry's Law constant
DA = diffusion coefficient in air

TABLE F-5
AT123D MODEL INPUT PARAMETER VALUES

Soil bulk density = 1.5 g/cc
Porosity = 0.3
Hydraulic conductivity = 0.5 m/hr
Hydraulic gradient = 0.005
Longitudinal dispersivity = 20.0 m
Transverse dispersivity = 2.0 m
Vertical dispersivity = 2.0 m

Loading (kg/hr) passed by SESOIL link program
Distribution coefficient = K_{oc} * fraction organic carbon
Source area = 10 m by 10 m, centered at 0,0
initial z penetration = 0

Degradation rates initially zero

TABLE F-6
MODEL OUTPUT DRAFT DAFS COMPARISON AND SOIL LEVELS

Compound	Oregon DAF	Mass DAF	DRINKING WATER LEVEL mg/L	SOIL TARGET LEVEL ppm
benzene	44.4	56.5	0.005	0.28
ethylbenzene	103.5	121.1	0.700	84.8
toluene	64.5	80.6	1.000	80.6
o-xylene	65.4	83.3	10.000	833.3
TCE	65.4	76.3	0.005	0.38
PCE	73.0	86.2	0.005	0.43
1,1,1-TCA	133.2	169.2	0.200	33.8
naphthalene	207.0	222.2	0.280	62.2

STATISTICAL RELATIONSHIPS

A linear regression was run on the eight DAF data pairs with DAFs for Oregon as the independent variable. The model was :

$$DAF_{Mass} = A + B*DAF_{Oregon}$$

That is, the regression was not forced through the origin. For the eight data pairs, the equation was

$$DAF_{Mass} = 12.39 + 1.053*DAF_{Oregon}$$

with an r of 0.9913. Thus, over the range of data spanned by these eight compounds, the correlation appears good. Table F-7 shows a comparison of the DAFs calculated by the model and those by the linear regression equation above for the eight indicator compounds. Differences between the two methods are less than 10 percent.

A multiple linear regression algorithm for DAF(Mass) as a function of K_{oc} and H was also developed along the same lines as that developed by Oregon. This allows the calculation of DAFs for compounds for which Oregon did not consider, and which also may be used exclusively from the linear regression cited above. Two models were considered:

(a) $DAF = A + B*H + C*K_{oc}$, and
(b) $DAF = B*H + C*K_{oc}$.

where A, B, and C are regression coefficients. As with the Oregon analysis, it proved that the constant term was not statistically different from zero, and the simpler second model was adopted. Regression analysis yielded:

$$\boxed{DAF = 6207 * H + 0.166 * K_{oc}}$$

The fit here is somewhat better than the r-squared value of .956 for the Oregon model in that one compound with a large residual (carbon tetrachloride with a residual of 30) was not used here, and the average difference is much smaller with the eight compounds than for Oregon's ten. Table F-8 shows the relationship between the model DAFs and the regression expression predicted values. Only one compound varies more than 10 percent while six of the eight have percent differences less than five.

TABLE F-7
COMPARISON BETWEEN MODEL DAFS AND LINEAR REGRESSION DAFS BASED ON OREGON DAFS

Compound	Model DAF	Regr. DAF	% Difference
benzene	56.5	59.1	4.60
ethylbenzene	121.1	121.4	0.25
toluene	80.6	80.3	-0.37
o-xylene	83.3	81.3	-2.40
TCE	76.3	81.3	6.55
PCE	86.2	89.3	3.60
1,1,1-TCA	169.2	152.6	-9.81
naphthalene	222.2	230.4	3.69

TABLE F-8
RESULTS OF THE MULTIPLE LINEAR REGRESSION EQUATION FOR H AND KOC

Compound	Model DAF	Predicted	% Difference
benzene	56.5	47.9	-15.2
ethylbenzene	121.1	116.7	- 3.6
toluene	80.6	86.3	7.1
o-xylene	83.3	82.8	- 0.5
TCE	76.3	77.2	1.2
PCE	86.2	90.4	4.9
1,1,1-TCA	169.2	169.4	0.1
naphthalene	222.2	221.1	- 0.5

BIODEGRADATION

It is intuitive that biodegradation may play an important role in attenuating the potential impact of residual contaminants in soils on groundwater. However, there are a great many site-specific conditions that will determine actual biodegradation rates. Further, literature values cover a wide range and the exact conditions under which they were estimated are rarely known. Literature values should be applied only with great caution to any estimation of contaminant fate and transport. In order to evaluate the potential effect of biodegradation, rate constants cited by Howard et al (1991) were input to the model for the five compounds of the eight indicator compounds known to degrade aerobically. This eliminated the chlorinated compounds TCE, PCE, and 1,1,1-TCA. In addition, one additional rate for benzene (0.002/day from the California LUFT guidance) was also run. Four runs were made for benzene as the most critical compound, at the California rate, at the high and low rates cited by Howard and at the geometric mean of the Howard high and low rates. Only one rate, the low Howard value, was used for each of the other four compounds. The reason for this will be seen shortly.

The degradation rates in Howard appear to be high, with half lives for the BTEX compounds on the order of days. This implies that within a year, residual concentrations in soil would be reduced by biodegradation several (three to six) orders of magnitude. Table F-9 presents the results of the model runs.

For all situations except for the two lowest rates for benzene, the DAFs become huge. In essence, this indicates that only trace amounts of the contaminants ever reach the groundwater table. Soil target level estimation using large DAFs and the linear approach should be done only with extreme caution. A contaminant in the subsurface will attempt to reach equilibrium concentrations in the air, moisture and sorbed to soil. At some total concentration, equilibrium solubility in moisture would be exceeded, indicating the probable presence of free product. In this case, the linearity and basic assumptions in the model may be violated. Of further consideration are the potential toxic effects on the biological population as concentrations of the compounds increase. For these circumstances, estimation of soil target levels considering biodegradation is very difficult.

TABLE F-9
RESULTS OF THE BIODEGRADATION RUNS

Compound	Rate in Soil 1/day	Rate in Water 1/day	DAF
benzene	0.002	0.001 *	84.7
benzene	0.0433	0.000963	2178.
benzene	0.0775	0.00817	1.5×10^4
benzene	0.1386	0.0693	5.7×10^7
toluene	0.0315	0.02475	8.7×10^6
ethylbenzene	0.0693	0.00304	1.8×10^{13}
o-xylene	0.02475	0.001899	2.8×10^5
naphthalene	0.01444	0.00269	8.6×10^{10}

* Note: Odencrantz's article on the California LUFT parameter values did not cite a rate for water. This was assumed here to be half that in soil. Note that not much more degradation occurs in the aquifer due to the rapid travel time to the receptor of about 11 to 12 days (large longitudinal dispersivity and low retardation).

SENSITIVITY

A detailed sensitivity analysis was not done at this point in time. However, Oregon did perform some sensitivity analyses, and sensitivity of these models as applied in California's LUFT program is discussed in another article (Odencrantz, et al, 1992)

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MCP APPENDIX G

SELECTION OF PRACTICAL QUANTITATION LIMITS FOR METHOD 1 CHEMICALS

APPENDIX G

Selection of Practical Quantitation Limits for Method 1 Chemicals

The majority of the Practical Quantitation Limits (PQL) for the MCP Method 1 chemicals are taken from one of three references on USEPA-approved laboratory methods. The references are as follows:

- USEPA Test Methods for Evaluating Solid Waste, SW-846, Third Edition (Revision 0), November 1986 (Reference 1)
- USEPA Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88/039, December 1988 (Revised July 1991) (Reference 2)
- Guide To Environmental Analytical Methods, Robert E. Wagner, Editor, Genium Publishing Corporation, 1992 (Reference 3)

The specific method on which the PQL is based is referenced in the two tables of PQLs in Section 3.1 (the explanation of the references follows Table 2-1). The references provide a method number. Below is a description of the various methods that appear in the references. From USEPA Test Methods for Evaluating Solid Waste (often referred to as SW-846), PQLs were excerpted from the following methods:

Method 8240:	Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS): Packed Column Technique
Method 8080:	Organochlorine Pesticides and Polychlorinated Biphenyls by Gas Chromatography
Method 8270:	Semivolatile Organic Compounds by Gas Chromatograhphy/Mass Spectrometry (GC/MS): Capillary Column Technique
Method 6010:	Inductively Coupled Plasma Atomic Emission Spectroscopy
Method 7470:	Mercury in Liquid Waste/Cold Vapor Technique

From the USEPA's Methods for the Determination of Organic Compounds in Drinking Water, PQLs were excerpted from the following methods:

Method 524.1:	Measurement of Purgeable Organic Compounds in Water by Packed Column Gas Chromatography/Mass Spectrometry

Method 524.2: Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry

Method 525.1: Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectrometry

From the Guide to Environmental Analytical Methods, a reference that condenses information in SW-846, EPA 200, 500, and 600 Series; Standard Methods; and the Contract Laboratory Program (CRP) into one book, PQLs were excerpted from the following methods:

Method 335: Determination of Total and Amenable Cyanide

Method 200.7: Atomic Absorption Methods

Method 508: Drinking Water Method for Pesticides: GC/ECD

Method 625: Priority Pollutants in Wastewater: Base/Neutrals, Acids, and Pesticides: GC/GC/MS

Method-Specific Adjustments

For certain methods, the PQL was not listed and had to be calculated from a Method Detection Limit (MDL). For the analysis of compounds in drinking water, sometimes a range of PQLs was provided because the method allowed for variations in laboratory methodologies or equipment. The specific assumptions that were made in selecting the PQL that appears in the Section 3.1 tables are discussed below under the various laboratory methods.

Methods 8270 and 8240:

The PQLs in the Section 3.1 tables are as listed in SW-846. No adjustments were necessary.

Method 8080:

The PQLs in the Section 3.1 tables were calculated from the Method Detection Limits provided in Table 1 of Method 8080 in (Reference 1). A formula is given in Method 8080 to calculate PQLs from MDLs. It is as follows:

PQL = MDL (Table 1) x Factor (Table 2)

For soil PQLs (in ug/kg), the factor in Table 2 that was used as a multiplier is 670, for low-level soil by sonication with GPC cleanup. For water PQLs, a factor of 10 was used as a multiplier.

Method 6010:

For compounds analyzed for using Method 6010, estimated instrumental detection limits are given in units of ug/l in Table 1 of Reference 1. Estimated instrumental detection limits are equivalent to PQLs. For water PQLs, the PQL was simply extracted from Table 1. For soil PQLs, a water-to-soil conversion factor was applied to the estimated detection limit to arrive at a PQL in units of mg/kg. The conversion factor was equal to 0.2; in other words, the estimated detection limit in ug/l was multiplied by 0.2 to arrive at a PQL in mg/kg. The conversion factor accounts for soil sample preparation procedures (in which one gram of soil is digested in 200 mL of water) and a units conversion (from ug/l to mg/kg).

Methods 524.1, 524.2 and 525.1 are used to analyze for compounds in drinking water; they are part of EPA's 500 series for organic compounds in drinking water.

Method 524.1:

For compounds analyzed for using Method 524.1, MDLs are reported in Table 3 of Method 524.1 (in Reference 2). The PQL was assumed to be equal to five times the MDL, an assumption supported in Standard Methods for the Examination of Water and Wastewater, 17th edition, 1989.

Method 524.2:

Analyzing for purgeable organics using this method can be done using two different laboratory setups: the first is a wide bore capillary column (Table 4 in Method 524.2) and the second is a cryogenic trapping option and a narrow bore capillary column (Table 5 in Method 524.2). Both tables appear in Reference 2. Because laboratories analyzing samples from 21E sites could use either technique, PQLs were calculated for both techniques and the higher of the two PQLs was selected for the development of the Method 1 standards. The higher of the two PQLs was chosen because either technique is acceptable and choosing the higher allows for both techniques to be used. (Both Table 4 and 5 report MDLs; so PQLs were calculated as five times the MDL.)

Method 525.1:

MDLs are provided in Method 525.1 Tables 4 and 6 in Reference 2. As with Method 524.2, two laboratory techniques are allowable under Method 525.1, one involves an ion trap mass spectrometer and the other involves a magnetic sector mass spectrometer. Both sets of PQLs were calculated (as five times the MDL) and the higher of the two PQLs for a given chemical was selected as the representative PQL for that method.

Method 335:

An MDL for cyanide is provided in EPA Method 335 in Reference 3. A PQL was estimated as five times the MDL.

Method 200.7:

Estimated instrumental detection limits are provided in Table 1 for Method 200.7 (in Reference 3). These are equivalent to PQLs.

Method 508:

Estimated detection limits (EDLs) are reported in Table 2 for Method 508. These are defined in a footnote to the table as being equivalent to MDLs. Therefore, PQLs were estimated as five times the EDLs.

Comments on PQLs for Specific Chemicals

For a few chemicals, certain assumptions were made in the calculation or identification of a PQL. These are listed below:

- Because o-xylene and p-xylene co-elute in Method 524.1, the PQL for xylenes in water is the sum of the individual PQLs for these two compounds.
- The PQL for trans-1,2-dichloroethylene was assumed to be the PQL for 1,2-dichloroethylene (mixed).